REPORT RESUMES

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ELECTRONIC DATA PROCESSING--I, A SUGGESTED 2-YEAR POST HIGH SCHOOL CURRICULUM FOR COMPUTER PROGRAMERS AND BUSINESS APPLICATIONS ANALYSTS.

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OFFICE OF EDUCATION, WASHINGTON, D.C.

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DESIGNED FOR USE IN PLANNING PREPARATORY PROGRAMS, THIS CURRICULUM CAN ALSO BE USEFUL IN PLANNING EXTENSION COURSES FOR EMPLOYED PERSONS. MATERIALS WERE ADAPTED FROM A GUIDE PREPARED BY ORANGE COAST COLLEGE, CALIFORNIA, UNDER A CONTRACTUAL ARRANGEMENT WITH THE U.S. OFFICE OF EDUCATION, AND REVIEWED BY A COMMITTEE COMPOSED OF SPECIALISTS IN DATA PROCESSING, COMPUTER APPLICATIONS, AND TECHNICAL EDUCATION. HOURS REQUIRED, DESCRIPTION OF THE COURSE, OUTLINE OF MAJOR DIVISIONS, AND REFERENCES ARE GIVEN FOR THE COURSES -- (1) FIRST YEAR -- DATA PROCESSING MATHEMATICS I, INTRODUCTION TO BUSINESS DATA PROCESSING, ELECTRONIC ACCOUNTING MACHINES, ACCOUNTING I, COMMUNICATIONS SKILLS I, DATA PROCESSING MATHEMATICS II, DATA PROCESSING APPLICATIONS, COMPUTER PROGRAMING I, ACCOUNTING II, AND COMMUNICATION SKILLS II, AND (2) SECOND YEAR -- COMPUTER PROGRAMING II, PROGRAMING SYSTEMS, STATISTICS, BUSINESS ORGANIZATION, COST ACCOUNTING, BUSINESS SYSTEMS DESIGN AND DEVELOPMENT, ADVANCED PROGRAMING SYSTEMS, DATA PROCESSING FIELD PROJECT, AND SOCIAL SCIENCES. THE TEACHER SHOULD HAVE TECHNICAL COMPETENCE, BUSINESS EXPERIENCE, AND PROFESSIONAL TRAINING IN EDUCATIONAL PROCESSES. STUDENTS SHOULD HAVE DEMONSTRATED COMPETENCE IN HIGH SCHOOL MATHEMATICS. THE APPENDIX INCLUDES A BIBLIOGRAPHY, A LIST OF AUDIOVISUAL AIDS, AND LABORATORY LAYOUTS. THIS DOCUMENT IS AVAILABLE AS GPO NUMBER FS 5.280--80024 FOR 40 CENTS FROM SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D.C. 20402. (PS)

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TECHNICAL EDUCATION PROGRAM SERIES NO. 4

ELECTRONIC DATA PROCESSING—I

A Suggested 2-Year Post High School Curriculum for Computer Programers and Business Applications Analysts

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE - - - - - - - - - Anthony J. Celebrezze, *Secretary*
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Foreword

THE PROCESSING OF DATA by electronic equipment has created vast changes in business and industry. Nowhere are these changes more apparent than in the occupations associated with the handling of business information. Much of the routine time-consuming work of obtaining, compiling, and reporting the information necessary for a business to operate can now be adapted to machine processing. As a direct consequence, the educational requirements for many business occupations have changed considerably. This is especially true of those occupations which require training beyond that provided by the general high school curriculum.

The curriculum outlined in this bulletin is primarily designed for a 2-year post high school program. It is intended as a guide to be used in planning preparatory programs, but it can also be useful in planning extension courses for employed persons. It provides a sequence of inter-related courses, each of which has been designed especially for this program. The techniques used to develop the curriculum will be of interest to those who are planning new programs in this field.

This curriculum guide was developed by Maurice W. Roney of the Technical Education Branch of the Division of Vocational and Technical Education. Other Branch personnel directly involved in its development included: Frank J. Coyle, Alexander C. Ducat, Robert M. Knoebel, Clarence E. Peterson, and Arthur B. Wrigley.

Materials for this publication were adapted from a guide prepared by Orange Coast College, Costa Mesa, Calif., and by Allison Bissell and Lawrence Quattlebaum of the International Business Machines Corporation. The materials provided by Orange Coast College were prepared under a contractual arrangement between the California State Department of Education and the U.S. Office of Education. The contributions of Messrs. Bissell and Quattlebaum resulted from a project they conducted at the IBM Systems Research Institute. As a final step in the developmental process, a review committee composed of specialists in data processing, computer applications, and technical education made an intensive review of the entire curriculum.

In summary, this curriculum guide is the product of the efforts of vocational educators, junior college administrators, and representatives of business and industry. As such, it should serve as a guide in developing curriculums that will meet local as well as national manpower needs in the field of electronic data processing.

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for Vocational and Technical Education.

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Electronic Data Processing

A Suggested 2-Year Post High School Curriculum For Computer Programers and Business Applications Analysts

General Program Requirements

SKILLED HANDLING and control of business records and accounts, inventory, sales, income, and expenditures are essential to management decisions. This curriculum guide outlines a sequence of courses designed to give the student an understanding of the principles of business operation, experience with techniques and methods of handling business data, functional competence in the application of data processing systems, and experience in computer programing.

Emphasis throughout the curriculum in this guide is upon business data processing and the use of machines in the solution of business problems. The courses outlined have been designed to prepare programers and applications analysts capable of being immediately productive in various entry jobs in business organizations. Graduates should be qualified to:

Apply currently available programing techniques to a defined problem with minimum supervision.

Program and operate any particular computer with a minimum of orientation.

Understand and master special techniques as the need occurs.

Communicate their properly documented programing decisions to personnel concerned.

Graduates should be able to advance rapidly from entry jobs to positions of greater responsibility. The curriculum emphasizes the use of a range and variety of equipment, although most schools will, of necessity, utilize a single data processing system consisting of a computer and its ancillary equipment. However, the graduate's proficiency with one complete data processing system should enable him to adapt to other systems quite rapidly.

Students entering the program should have demonstrated competence in high school mathematics, especially algebra. In addition, they should have shown an aptitude for logical reasoning. The latter may be more significant in the student's progress than credit in advanced mathematics courses.

Essential to the success of any curriculum is a well-qualified instructional staff. The qualifications needed in this program include technical competence, business experience, and professional acumen, together with training and experience in the practical work of data processing in business activities. Professional training in educational processes and teaching methods should be required of all teachers.

The curriculum and courses suggested in this guide constitute only one approach to instruction in a field of employment which is in a state of transition. The course outlines are short and descriptive. Modifications and adaptations will usually be necessary to meet the scheduling requirements of a particular school.

Electronic Data Processing

Curriculum Outline

Curriculum outline, by semester	Hours per week				Page
	Class	Lab.	Study	Total	
	FIRST YEAR				
FIRST SEMESTER					
M 103 Data Processing Mathematics I	3	0	6	9	5
C 102 Introduction to Business Data Processing	2	1	5	8	6
C 105 Electric Accounting Machines	3	5	6	14	7
A 104 Accounting I	4	0	8	12	9
G 113 Communication Skills I	3	0	6	9	11
Total	15	6	31	52	
SECOND SEMESTER					
M 124 Data Processing Mathematics II	4	0	8	12	13
C 122 Data Processing Applications	2	1	4	7	14
C 124 Computer Programing I	3	4	6	13	16
A 144 Accounting II	4	0	8	12	18
G 123 Communication Skills II	3	0	6	9	20
Total	16	5	32	53	
	SECOND YEAR				
FIRST SEMESTER					
C 215 Computer Programing II	3	5	6	14	22
C 213 Programing Systems	3	1	6	10	23
A 243 Statistics	4	0	8	12	24
A 253 Business Organization	2	0	4	6	26
A 263 Cost Accounting	3	0	6	9	27
Total	15	6	30	51	
SECOND SEMESTER					
C 264 Business Systems Design and Development	3	2	6	11	28
C 266 Advanced Programing Systems	4	4	8	16	30
C 262 Data Processing Field Project	1	3	6	10	33
G 263 Social Science	3	0	6	9	34
Total	11	9	26	46	

The Curriculum: Its Content and Organization

THE SEQUENCE of the courses in a 2-year technical curriculum is as important as the content of the courses. In general, the subject matter in a technical curriculum is carefully correlated in groups of concurrent courses. This is in sharp contrast to the more familiar arrangement of professional curriculums in which basic and somewhat unrelated courses make up the first part of the study program and specialization is deferred to subsequent terms.

This curriculum is designed to provide the maximum specialization achievable in a 2-year program. It is consistent with educational practices that have been successful in attracting and holding capable students who are primarily interested in specialized occupational fields. The central purpose is to develop occupational competency. To accomplish this, it has been necessary to integrate theory and practice and to program all courses for maximum effectiveness.

In most successful technical curriculums the first semester includes a substantial introduction to the field of specialization. In this curriculum, two courses, C 102 *Introduction to Business Data Processing* and C 105 *Electric Accounting Machines,* introduce the more interesting and practical elements of the study program in the first semester. These courses identify the basic purpose to be served by organizing and equipping a business for modern high-speed data processing. This introduction has the advantage of motivating students whose primary interest is in the practical aspects of education. Also, an introduction to the more sophisticated aspects of his future occupation helps the student to appreciate and to put in perspective the less glamorous, but equally valuable, courses such as those in accounting, mathematics, and communications.

Computer programing is introduced as early as possible in the curriculum for the same reasons. The computer is central in the interest of every student because it represents the key to success in the occupational field. Furthermore, an understanding of the unique functions of the computer in processing data will increase the student's appreciation for all of the more routine clerical and accounting functions of the business operation. The computer is introduced along with some of its most important applications in two second semester courses: C 124, *Computer Programing I* and C 122, *Data Processing Applications.* These courses are correlative and each effectively reinforces the other.

This early introduction to the mechanics of data processing has an additional advantage. The student becomes familiar with the basic requirements of a data processing system in the first year of the program, and is thus able to devote more attention in the second year to systems analysis and systems design.

Two significant elements of the curriculum are mathematics and communication skills. Courses in these basic skills contain materials selected for maximum utility in business occupations and are scheduled in the first two semesters.

Mathematics courses include basic logic, the number systems, and Boolean algebra. Special attention is given to the applications of mathematics in the solution of practical business problems. Concepts of approximation and allowable error are introduced to give a basis for problem-solving techniques that may be used in cases where absolute values cannot be obtained.

Communications courses emphasize the mechanics of reading, writing, listening, speaking, and reporting. Instructors should establish standards of clarity, conciseness, and neatness in the beginning courses. In addition, instructors in technical courses should set increasingly high standards for student work in reporting. In the final phases of the 2-year program, the standards of reporting should approach those required by business organizations. At the same time, instructors should encourage individual style and initiative by allowing as much freedom as possible in reporting, consistent with established school standards.

Spiral teaching is another feature of technical education that is incorporated in this curriculum. A concept, once introduced, is never dropped, but is extended and applied in subsequent courses and is reinforced, where necessary, by a return to previous subjects and topics. In the second year of the program, the use of the computer in the business organization is again the major emphasis. Building on the general and basic concepts introduced in the first year, the student progresses to such topics as advanced and automatic coding, work simplification techniques, and feasibility studies. At the same time, he is introduced to the use of statistics, including methods of description, analysis, and statistical inference.

In the final term the emphasis shifts to a more individualized form of instruction. Students receive more individual and group assignments which require a wider use of resources other than formal classroom instruction. Studying the procedures used in the analysis and design of systems, programing advanced problems, and carrying a major field project through to completion constitute the major part of the last semester's work. This enables the student to tie together and reinforce parts of previous courses which he may have only partially understood at the time he first studied them. It also enables him to evaluate his own potential under the supervision of competent instructors and to recognize those areas of the technology in which he may need additional study.

Student workloads have been given careful consideration in the design of this curriculum. The amount of outside study, as indicated in the curriculum outline, is approximately 30 hours per week. Total workloads range from 46 to 53 hours per week—not an excessive requirement in a 2-year technical program. Not more than five courses requiring outside study are scheduled in any semester.

The lists of texts and references shown at the end of each course outline are by no means complete. New materials and books for this field of study are appearing with increasing frequency. It is probable, therefore, that many publications of value are not included. In any event instructors will need to draw upon a number of sources for suitable reference materials.

The job of preparing course instructional materials, teaching guides, units of instruction, and making the curriculum fit local needs and conditions is the responsibility of the instructional staff utilizing the curriculum. In short, the individual laboratory or classroom teacher with competent and expert advice will decide on the actual units of instruction to be included, the time to be spent on each topic, textbooks and references to be used, and the supplementary materials necessary to develop the best learning situation. The curriculum can only suggest those areas of information which should be covered, to give students the knowledge and the competency necessary to enter and progress in business and industry. It is for the instructor to determine the proper application of the concepts outlined in this curriculum.

Much valuable instructional material can be obtained from equipment manufacturers, professional societies, and various business and industrial associations. Complete libraries of tape and card programs are available from computer manufacturers as examples of programs developed for actual business operations. Operation manuals and educational materials of many types are also available from these sources.

Advisory committees can be very helpful in program planning and coordination. Such committees may include representatives from industrial and business enterprises, State unemployment services, organized labor groups, professional or trade associations, and other local groups concerned with industrial services. One of the most important functions of an advisory committee is to provide a medium of communication. The committee can interpret the needs of the community to the school and at the same time make the contributions of the school known to the community.

An alphabetical list of texts and references, a partial list of teaching aids, and suggestions for laboratory arrangements appear in the appendixes.

COURSE OUTLINES: FIRST YEAR, FIRST SEMESTER

M 103, Data Processing Mathematics I

Hours Required

Class, 3; Laboratory, 0

Description

The language of business has numerical bases. This course provides the necessary foundation in numerical concepts for the study of accounting and machine processes. It is the first of two mathematics courses designed specifically for business data processing.

One year of high school algebra is the required background for this class.

Major Divisions

I. The Concepts of Notation
II. Basic Algebra
III. The Number Systems
IV. Representation of a Number With an Arbitrary Base
V. Fixed and Floating Point Numbers
VI. Precision and Significance
VII. Linear Equations

DIVISION I. The Concepts of Notation

A. Subscripts
B. Functional notations
C. Use of exponents
D. Infinite sum
E. The factorial notation
F. Arithmetic progressions and series

DIVISION II. Basic Algebra

A. Algebraic expressions
B. Algebraic fractions
C. Factoring
D. Polynomials

DIVISION III. The Number Systems

A. Base 10 numbering system
B. Rational and irrational numbers
C. Powers and roots
D. Logarithms

DIVISION IV. Representation of a Number With an Arbitrary Base

A. Binary
B. Octal
C. Conversion from one base to another

DIVISION V. Fixed and Floating Point Numbers

A. Fixed point
    1. Scaling
    2. Advantages
B. Floating point
    1. Mantissa
    2. Exponent
    3. Advantages

DIVISION VI. Precision and Significance

A. Precision
B. Significance
C. Absolute and relative errors

DIVISION VII. Linear Equations

A. Equations with one unknown
B. Equations with two and greater unknowns
C. Determinants

Texts and References

COURANT. *What Is Mathematics?*
CROWDER. *The Arithmetic of Computers*
MOORE. *Fundamental Principles of Mathematics*
RICHARDSON. *Fundamentals of Mathematics*
TITCHMARSH. *Mathematics for the General Reader*

C 102, Introduction to Business Data Processing

Hours Required

Class, 2; Laboratory, 1

Description

All data processing systems, regardless of size, type, or basic use, have certain fundamental operational principles. This course illustrates the development of computer systems from manual methods to the stored program, and is designed to provide a foundation for detailed study of specific systems.

Major Divisions

I. Evolution of Data Processing
II. The Business Organization and Data Processing
III. Development of a Data Processing System
IV. Input-Output Media
V. Internal Processing
VI. Computer Characteristics

DIVISION I. Evolution of Data Processing

A. Highlights of data processing development
B. Manual methods through key-driven machines
C. Brief overview of punched card systems
D. The need for electronic data processing systems

DIVISION II. The Business Organization and Data Processing

A. Function of business
B. The organization chart
  1. The company
  2. The data processing unit
C. The nine key operation
D. Forms: flow chart
E. Procedures: flow

DIVISION III. Development of a Data Processing System

A. Components of systems
  1. Stored programs
  2. Elements of problem-solving
  3. Central processing unit
  4. Primary storage
  5. Arithmetic unit
  6. Logic ability
  7. Documentation
B. Types of systems
  1. Manual
  2. Mechanical
  3. Electrical

DIVISION IV. Input-Output Media

A. Card reader
B. Card punch
C. Magnetic tape unit
D. Paper tape reader
E. Paper tape punch
F. Magnetic character sensing
G. Optical reader
H. Printers
I. Random access devices

DIVISION V. Internal Processing

A. Loading the stored program
B. Accessing
C. Registers
D. Data flow

DIVISION VI. Computer Characteristics

A. Analog and digital
B. Serial and parallel
C. Buffered and unbuffered
D. Sequential and nonsequential
E. Numeric and alphanumeric
F. Variable and fixed

References

LEEDS and WEINBERG. *Computer Programing Fundamentals*

MCCRACKEN, WEISS, and LEE. *Programing Business Computers*

C 105, Electric Accounting Machines

Hours Required

Class, 3; Laboratory, 5

Description

This is a survey of electric accounting machines, illustrating the need for machines in accounting and record keeping, and the concept, power, and flexibility of the unit record. The importance and the scope of unit record equipment as an independent system will be developed throughout the course. Laboratory exercises will be executed involving planning and wiring a range of unit record equipment. Practical exercises offered will be typical of those performed in the existing electric accounting machine installations.

Major Divisions

I. The Unit Record
II. Machine Functions
III. Elements of a Machine
IV. The Card Punch and Verifier
V. Interpreter
VI. Sorter
VII. Reproducing Punch
VIII. Collator
IX. Tabulators: Accounting Machines
X. Calculators

DIVISION I. The Unit Record
  A. Card format
  B. Card code
  C. Control punches
  D. Card field
  E. Flexibility in processing

DIVISION II. Machine Functions
  A. Recording
  B. Classifying
  C. Calculating
  D. Report preparation

DIVISION III. Elements of a Machine
  A. Card feeding
  B. Card reading
  C. Printing units
  D. The control panel

DIVISION IV. The Card Punch and Verifier
  A. Functions
  B. Features
  C. Alphabetic and numeric punching
  D. Duplicating
  E. The control card
  F. Verification

DIVISION V. Interpreter
  A. Functions
  B. Features
  C. The column split
  D. Interpreting
  E. The selector
  F. Interpreting with selection

DIVISION VI. Sorter
  A. Features
  B. Operating procedures
  C. Numerical and alphabetic sorting
  D. Block sorting

DIVISION VII. Reproducing Punch
  A. Features
  B. Functions
  C. Operating procedures
  D. Reproducing
  E. Gang punching
  F. Verifying

DIVISION VIII. Collator
  A. Features
  B. Functions
  C. Operating procedures
  D. Sequence checking
  E. Selection
  F. Merging

DIVISION IX. Tabulators—Accounting Machines
  A. Functions
  B. Features
  C. Control Panel
    1. Detail printing
    2. Program control
    3. Addition and subtraction
    4. Group printing and group indication
    5. Selective printing
    6. Summary punching

DIVISION X. Calculators
  A. Functions
  B. Features

C. Control Panel
  1. Add
  2. Subtract
  3. Multiply
  4. Divide

References

All manufacturers' technical manuals covering machines.

McGill. *Punched Cards: Data Processing for Profit Improvement.*

Students at work in a typical electronic data processing laboratory.
Seated at the left is a student at the console of the computer.
Students at right and center rear are operating punched card equipment.

A 104, Accounting I

Hours Required

Class, 4; Laboratory, 0

Description

This course emphasizes the principles, techniques, and tools of accounting. It provides the necessary background understanding of the mechanics of accounting—collecting, summarizing, analyzing, and reporting information about the business. As the mechanics of accounting become well formulated, it is practical to introduce the use of data processing machines in performing the accounting functions within an organization. Case studies are used to effectively impart these concepts.

Major Divisions

I. Basic Accounting Concepts
II. The Accrual Concept and the Income Statement
III. Bookkeeping: The Mechanics of Accounting
IV. Accounts Receivable and Fixed Assets
V. Capital Stock, Surplus, Bonds
VI. Review of Accounting Concepts

DIVISION I. Basic Accounting Concepts
- A. The language of accounting
- B. Underlying principles
  - 1. Expressing facts in dollars
  - 2. The business entity
  - 3. Value equals cost
  - 4. Assets equal equities (dual-aspect principle)
  - 5. The accrual principle
- C. Fundamental conventions: doctrines of—
  - 1. Consistency
  - 2. Conservation
  - 3. Materiality
- D. The balance sheet
  - 1. Current assets
  - 2. Fixed assets
  - 3. Other assets
  - 4. Liabilities
  - 5. Current liabilities
  - 6. Other liabilities
- E. Balance sheet changes
- F. An alternative view of the balance sheet
- G. Case studies

DIVISION II. The Accrual Concept and the Income Statement
- A. The accrual concept
  - 1. The accounting period
  - 2. Measurement of expense
  - 3. Measurement of revenue
  - 4. A remainder: the dual-aspect concept
  - 5. A remainder: materiality
  - 6. Tax accounting vs. business accounting
- B. The income statement
  - 1. Cost of goods sold
  - 2. Wages and salaries
  - 3. Continuous transactions
- C. Retained earnings reconciliation statement
- D. Case studies

DIVISION III. Bookkeeping: The Mechanics of Accounting
- A. Introduction
- B. Bookkeeping tools
  - 1. The account
  - 2. Debit and credit
  - 3. The ledger
  - 4. The journal
  - 5. Special journals
- C. The adjusting and closing process
  - 1. Adjusting entries
  - 2. Closing entries
  - 3. Ruling and balancing accounts
  - 4. The trial balance
  - 5. The worksheet
- D. Locating errors revealed by the trial balance

DIVISION IV. Accounts Receivable and Fixed Assets
- A. Accounts receivable
  - 1. Accounting recognition of bad debts
  - 2. Bad debt write-off
  - 3. Collection of a bad debt written off
  - 4. Summary
- B. Fixed assets and depreciation
  - 1. Acquisition of fixed assets
  - 2. Betterments vs. maintenance
  - 3. Depreciation
  - 4. Write-off of fixed assets
  - 5. Sale or exchange of fixed assets

- C. Intangible assets
- D. Case studies illustrating the accounting mechanics as performed on data processing equipment.

Division V. Capital Stock, Surplus, and Bonds

- A. Capital Stock
  - 1. Recording the issue
  - 2. Balance sheet presentation
  - 3. Treasury stock
- B. Surplus
  - 1. Significance
  - 2. Stock dividends
  - 3. Surplus reserves
  - 4. Other types of reserves
- C. Bonds
  - 1. Recording the issue
  - 2. Balance sheet presentation
  - 3. Bond interest, premium, and discount
  - 4. Issue costs
  - 5. Retirement of bonds
  - 6. Refunding a bond issue

Division VI. Review of Accounting Concepts

- A. The balance sheet
- B. The income statement
- C. Limitations on accounting data
- D. Diversity in detail
- E. Summary
- F. Case studies illustrating the basic accounting functions as performed on computing machines

Texts and References

Anthony. *Management Accounting: Text and Cases*

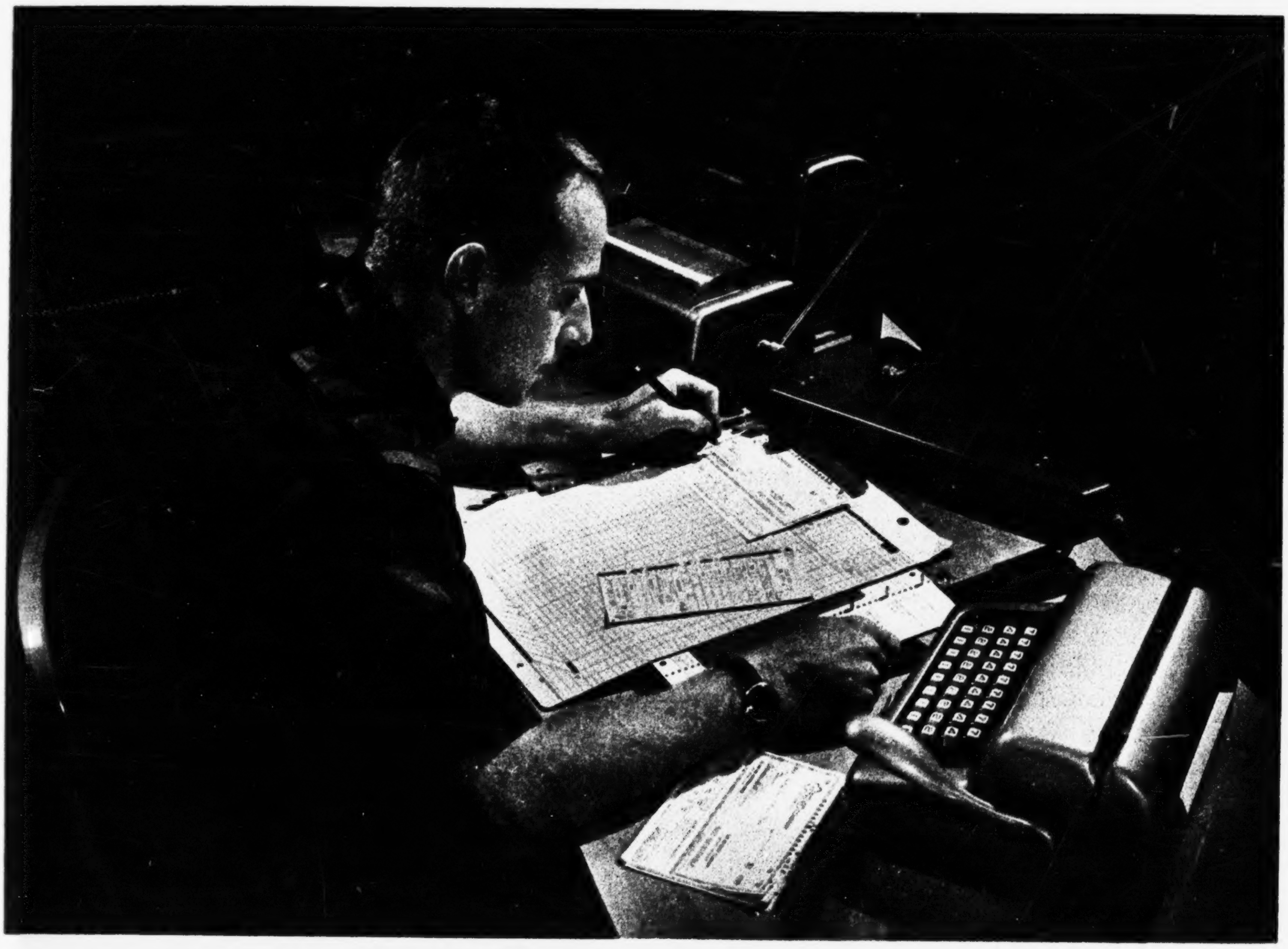
Finney. *Principles of Accounting: Introductory*

Holmes, Maynard, Edwards, *and* Meier. *Elementary Accounting*

———. *Intermediate Accounting*

Malchman *and* Slavin. *Foundations of Accounting for Managerial Control.*

Rankin. *What's Behind a Financial Statement*



Student operating a key sort machine.

G 113, Communication Skills I

Hours Required

Class, 3; Laboratory, 0

Description

It is recognized that communication is an essential part of all phases of business and industry. Effective communication abilities are required for those who advance to responsible positions in business organizations. In this course, the student's strength and weaknesses are analyzed through the use of diagnostic tests and exercises in writing, speaking, reading, and listening. Both technical and social skills are emphasized throughout the entire course.

Major Divisions

I. Sentence Structure
II. Using Resource Materials
III. Written Expression
IV. Talking and Listening
V. Improving Reading Efficiency
VI. Graphic Communication

DIVISION I. Sentence Structure

A. Review of basic parts of speech
B. What makes complete sentences
C. Use and placement of modifiers, phrases, and clauses
D. Sentence conciseness
E. Exercises in sentence structure

DIVISION II. Using Resource Materials

A. Orientation in use of school library
  1. Location of reference materials
  2. Mechanics for effective use
  3. Dewey Decimal System
B. Dictionaries
  1. Types of dictionaries
  2. How to use dictionaries
  3. Diacritical markings and accent marks
C. Other reference sources
  1. Technical manuals and pamphlets
  2. Bibliographies
  3. Periodicals
D. Exercises in the use of resource materials
  1. Cumulative indexes
  2. Atlases
  3. Encyclopedias
  4. Other

DIVISION III. Written Expression

A. Paragraphs
  1. Development
  2. Topic sentences
  3. Unity and coherence
B. Types of expression
  1. Inductive and deductive reasoning
  2. Figures of speech
  3. Analogies
  4. Syllogisms
  5. Cause and effect
  6. Other
C. Written exercises in paragraphs
D. Descriptive reporting
  1. Organization and planning
  2. Emphasis on sequence, continuity, and delimitation of pertinent data or information.
E. Techniques of exposition
F. Letter writing
  1. Business letters
  2. Personal letters
G. Mechanics
  1. Capitalization
  2. Punctuation
  3. Spelling
    a. Word division: syllabification
    b. Prefixes and suffixes
    c. Word analysis and meaning: context clues, content analysis, phonetics, etc.
H. Exercises in mechanics of written speech

DIVISION IV. Talking and Listening

A. Organization of topics or subject
B. Directness in speaking
C. Gesticulation and use of objects to illustrate
D. Conversation courtesies
E. Listening faults
F. Taking notes
G. Understanding words through context clues
H. Exercises in talking and listening

DIVISION V. Improving Reading Efficiency

A. Reading habits
  1. Correct reading posture
  2. Light sources and intensity
  3. Developing proper eye span and movement

    4. Scanning
    5. Topic sentence reading
  B. Footnotes, index, bibliography, cross-reference, etc.
  C. Techniques of summary
    1. Outline
    2. Digest of brief
    3. Critique
  D. Exercises in reading improvement
    1. Reading for speed
    2. Reading for comprehension

DIVISION VI. Graphic Communication

  A. Bar charts and histograms
  B. Linear graphs
  C. Effective pictorial presentations

Texts and References

BAIRD *and* KNOWER. *Essentials of General Speech*

——— *General Speech: An Introduction*

BORDEAUX. *How To Talk More Effectively*

CROUCH *and* ZETLER. *Guide to Technical Writing*

GUAM, GRAVES, *and* HOFFMAN. *Report Writing*

THOMPSON. *Fundamentals of Communication: An Integrated Approach*

WARRINER *and* GRIFFITH. *English Grammar and Composition: A Complete Handbook*

WITTY. *How To Improve Your Reading*

YOUNG *and* SYMONIK. *Practical English: Introduction to Composition*

Instructor and student check a wired control panel for an accounting machine. The control panel gives the machine flexibility, because by changing control panels a new set of instructions for processing data is given to the machine.

COURSE OUTLINES: FIRST YEAR, SECOND SEMESTER

M 124, Data Processing Mathematics II

Hours Required

Class, 4; Laboratory, 0

Description

Data Processing Mathematics II is a continuation of M 103, *Data Processing Mathematics I* (see p. 5). Numbers systems, forms, and methods basic to data processing are continued and extended.

Major Divisions

I. Concept of an Iterative Process
II. Solution of Simultaneous Linear Equations
III. Logic
IV. Boolean Algebra
V. Applications of Numerical Solutions to Physical Problems
VI. Classification of Errors in the Numerical Solutions of a Problem

Division I. Concept of an Iterative Process

A. Algorithm
B. Applications of iterative process
C. Advantages

Division II. Solution of Simultaneous Linear Equations

A. Definition and notation
B. Elimination scheme
C. Iterative method

Division III. Logic

A. Introduction to logic
B. Deductive logic
C. Inductive logic
D. Logical basis
E. Logical basis for mathematics

Division IV. Boolean Algebra

A. Connectives
B. Truth tables
C. Machine implementation of arithmetic operations.
D. Simplification of Boolean algebra expressions
E. Information retrieval techniques

Division V. Applications of Numerical Solutions to Physical Problems.

Division VI. Classification of Errors in the Numerical Solutions of a Problem

A. Error in mathematical approximation
B. Error in the measurement of parameters
C. Truncation errors
D. Round-off errors
E. Ill-conditioned equations

Texts and References

Hohn. *Applied Boolean Algebra*
Richardson. *Fundamentals of Mathematics*
Wade *and* Taylor. *Fundamental Mathematics*

C 122, Data Processing Applications

Hours Required

Class, 2; Laboratory, 1

Description

This course is designed to acquaint the second semester student with business data processing applications. Practical case studies illustrate the use of data processing equipment in various types and sizes of representative companies. The student gains an understanding of the advantages to be realized by the use of machine data processing systems.

Major Divisions

- I. Accounts Receivable
- II. Accounts Payable
- III. Payroll
- IV. Inventory Control

Division I. Accounts Receivable

- A. Theory and concepts of the accounts receivable application
    - 1. Objectives and importance of accounts receivable
    - 2. Relationship of receivables to the distribution family
    - 3. Making entries
    - 4. Controls
- B. Basic approaches to accounts receivable: introduction
    - 1. Open item approach
    - 2. Balance forward approach
- C. Open item approach
    - 1. Cash payments
        - a. Full payments
        - b. Partial payments
        - c. Paid file
    - 2. Trial balance and statements
        - a. Aged trial balance
        - b. Aged statements
        - c. Out-of-balance reconstruction
        - d. Audits and controls
    - 3. Open item system using electromechanical data processing machines
    - 4. Open item system using basic computing machines
- D. Balance forward approach
    - 1. Cash payments
        - a. Full payments
        - b. Partial payments
        - c. Cash receipts register
    - 2. Trial balance and statements
        - a. Aged trial balance
        - b. Aged statements
        - c. Automatic payment reentry
    - 3. Balance forward system using electric accounting machines
    - 4. Balance forward system using basic computing machines
- E. Summary
    - 1. Comparison of open item and balance forward approaches
    - 2. Advantages of mechanized accounts receivable methods
- F. Case studies

Division II. Accounts Payable

- A. Theory and concepts of the accounts payable application
    - 1. Functions of the accounts payable department
    - 2. Effect on general ledger
- B. Establishing liability
    - 1. Purchases requisition
    - 2. Purchasing department functions
    - 3. Purchase order preparation
- C. Validating liability
    - 1. Internal expenses
    - 2. Outside charges
    - 3. Receiving reports
    - 4. Debit memos
- D. Posting liabilities
    - 1. Ledgers
    - 2. Discounts
        - a. Trade
        - b. Cash
        - c. Anticipation
- E. Writing checks
- F. Applying distributions
    - 1. Allocating expenses
    - 2. Analyzing records
- G. Accounting controls
- H. Accounts payable system using electric accounting machines

- I. Accounts payable system using basic computing machines
- J. Advantages of mechanized accounts payable methods
- K. Case study

DIVISION III. Payroll

- A. Theory and concepts of the payroll application
  - 1. Interrelationship with other application areas
  - 2. Effect on the balance sheet
  - 3. Effect on the income statement
- B. Payroll source data
  - 1. Attendance documents
  - 2. Production documents
    - a. Job cards
    - b. Time sheets
    - c. Daily time tickets
  - 3. Tax and miscellaneous deduction documents
  - 4. Computative data
  - 5. Classification data
  - 6. Identification data
- C. Controls
- D. Types of payroll
  - 1. Hourly
  - 2. Salary
  - 3. Incentive
- E. Payroll calculation
  - 1. Piecework
  - 2. Job guarantee
  - 3. Day guarantee
- F. Overtime
  - 1. Reporting
  - 2. Computing
  - 3. Variations
- G. Gross-to-net
  - 1. Tax computation
    - a. Federal income taxes
    - b. FICA
    - c. State income taxes
    - d. Tax proof
  - 2. Deduction computation
    - a. Fixed
    - b. One-time
- H. Payroll register
- I. Checks and earnings statements
- J. Check reconciliation
- K. Tax reports
- L. Payroll cost analysis and distribution
  - 1. For accounting purposes
  - 2. For management control
  - 3. For cost analysis
- M. Procedure study requirements
  - 1. Volume considerations
  - 2. Reports
  - 3. Schedule requirements
  - 4. Payroll computations
  - 5. Management requirements
- N. Mechanized approaches
  - 1. Payroll systems using electric accounting machines
  - 2. Payroll systems using basic computing machines
- O. Summary
  - 1. Procedural advantages of a mechanized payroll
  - 2. Management advantages of a mechanized payroll
- P. Case studies

DIVISION IV. Inventory Control

- A. Theory and concepts of the inventory control function
  - 1. Inventory control vs. material accounting
  - 2. Typical business inventories
  - 3. Management objectives of inventory control
- B. The basic inventory formula
  - 1. Factors involved
  - 2. Modifications depending upon requirements of the business
  - 3. "Minimum" and "reorder point" systems
- C. Establishing controls
  - 1. Coding methods
  - 2. Accuracy
    - a. Machine controls
    - b. Accounting controls
- D. Procedural approaches
  - 1. The balance forward plan
  - 2. The unit tub file plan
  - 3. The stock allocation plan
  - 4. The automatic reorder plan
- E. Physical inventory
- F. Inventory control systems using electric accounting machines
- G. Inventory control systems using basic computing machines
- H. Case studies

Texts and References

Manufacturers' manuals

LEVIN *Office Work and Automation*

LEWIS *Accounting Reports for Management*

C 124, Computer Programing I

Hours Required

Class, 3; Laboratory, 4

Description

The student will study the functions and capabilities of a specific data processing machine and will become familiar with some of the tools and raw material necessary for becoming a programer. He will perform programing drills, exercises, and case studies which will serve to bridge the gap from the theoretical to the real world of data processing. The 4-hour-per-week laboratory session will further reinforce basic principles by providing practical applications.

Major Divisions

I. Computer Applications
II. Organization of the Data Processing System
III. Man-Machine Communications
IV. Instructions: Card System
V. Methods of Program Debugging
VI. Housekeeping Techniques
VII. Loops and Indexing
VIII. Subroutines

Division I. Computer Applications
- A. Effect of computer size
  - 1. Large scale
  - 2. Medium scale
  - 3. Small scale
- B. Specific application requirements
  - 1. Commercial
  - 2. Scientific
  - 3. Mixed
- C. An integrated data processing system

Division II. Organization of the Data Processing System
- A. Components
  - 1. Functions
  - 2. Features
  - 3. Speed
- B. Instruction format
- C. Storage organization
  - 1. Coding systems
  - 2. Addressing scheme
- D. Instruction and data flow
  - 1. Registers
  - 2. Instruction phase
  - 3. Execution phase

Division III. Man-Machine Communications
- A. Console control
  - 1. Man to machine
  - 2. Machine to man
- B. Sense switch control
- C. Inquiry stations
- D. Machine to man printouts
  - 1. Messages
  - 2. Memory printouts

Division IV. Instructions: Card System
- A. Format control codes
- B. Card system input-output instructions
- C. Data movement instructions
- D. Arithmetic
- E. Branching
- F. Logic instructions
- G. Miscellaneous codes

Division V. Methods of Program Debugging
- A. Debugging a program before run time
- B. Debugging a program at run time
- C. Programing for ease of checkout

Division VI. Housekeeping Techniques

Division VII. Loops and Indexing
- A. Steps in programing a loop
- B. Index registers
- C. Various types of loops

Division VIII. Subroutines
- A. The use of subroutines
- B. Subroutines and calling sequence
- C. The soft ware as a computer

Texts and References

All manufacturers' technical manuals covering specific systems

Alt. *Advances in Computers*

Bell. *A Management Guide to Electronic Computers*

Canning. *Electronic Data Processing for Business and Industry*

Chapin. *An Introduction to Automatic Computers*

Gotleib *and* Hume. *High-Speed Data Processing*

GREGORY *and* VANHORN. *Automatic Data Processing Systems*

JEENEL. *Programing for Digital Computers*

Key to Successful Electronic Data Processing. *Journal of A.C.M.*, January 1959.

KOZMETSKY *and* KIZCHER. *Electronic Computers Management Control*

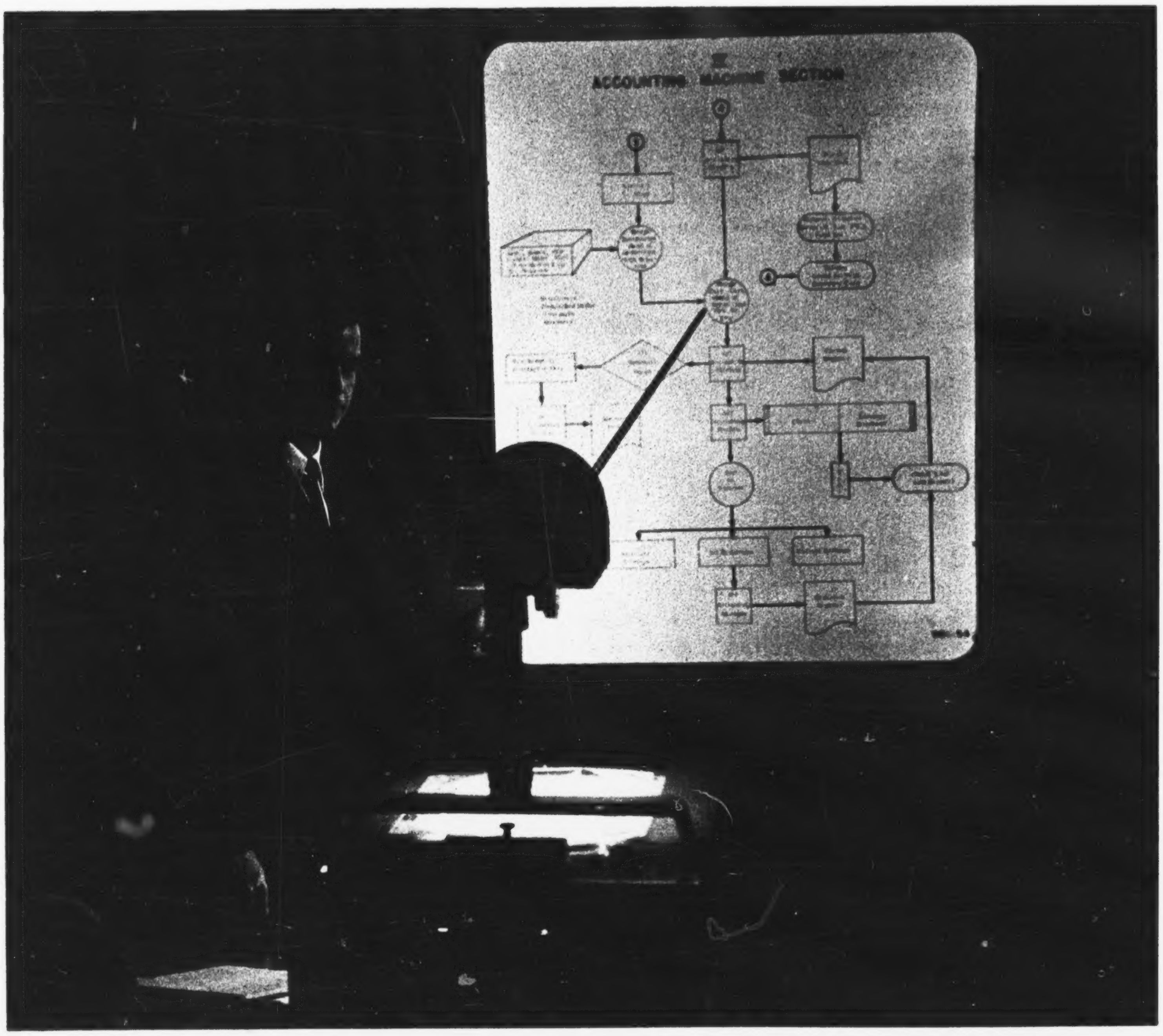
LEEDS *and* WEINBERG. *Computer Programing Fundamentals*

MCCRACKEN. *Digital Computer Programing*

——— *Programing Business Computers*

POSTLEY. *Computers and People*

WRUBEL. *A Primer of Programing for Digital Computers*



Instructor and class discuss flow chart steps in a typical data processing application.

A 144, Accounting II

Hours Required

Class, 4; Laboratory, 0

Description

This course emphasizes management uses of accounting information. The emphasis is on accounting as a source of data for management control rather than on bookkeeping skills. Accounting services are shown as they contribute to the recognition and solution of a management problem. The concept of performing accounting services on data processing machines is emphasized throughout the course through the use of case studies.

Major Divisions

- I. Management's Use of Accounting Information
- II. Overall Reporting and Analysis: The Funds Flow
- III. Overall Reporting and Analysis: Ratios and Percentages
- IV. Challenges to Conventional Accounting Concepts
- V. Control: General Considerations
- VI. Control: Analysis of Cost Accounting Variances
- VII. Period Planning or Budgeting
- VIII. Project Planning: Relevant Costs

DIVISION I. Management's Use of Accounting Information

- A. Purposes of accounting information
  - 1. Planning
  - 2. Control
- B. General considerations
  - 1. Different figures for different purposes
  - 2. Accounting figures are approximations
  - 3. Working with incomplete data
  - 4. Figures only partial evidence

DIVISION II. Overall Reporting and Analysis: The Funds Flow

- A. Funds flow statement
- B. Statement refinements
  - 1. Changes in owner's equity
  - 2. Changes in fixed assets
  - 3. Variations in presentation

DIVISION III. Overall Reporting and Analysis: Ratios and Percentages

- A. Ratios
  - 1. Tests of liquidity
  - 2. Tests of profitability
  - 3. Market tests
- B. Comparison of ratios
  - 1. Difficulties in making comparisons
  - 2. Possible bases for comparison
- C. Percentages
  - 1. Choice of a base
  - 2. Averaging percentages

DIVISION IV. Challenges to Conventional Accounting Concepts

- A. Price level concepts
- B. Overall adjustments
- C. Inventory valuations
- D. Fixed assets and depreciation
- E. Direct costing

DIVISION V. Control: General Considerations

- A. Communication
- B. Motivation
  - 1. Responsibility centers
  - 2. Charging costs to responsibility centers
  - 3. Internal auditing and control
  - 4. Management attitude
- C. Appraisal of performance
  - 1. Standards
  - 2. Necessity for supervisor's concurrence
  - 3. Management by exception
  - 4. Problem of appraisal
  - 5. Control and the controller

DIVISION VI. Control: Analysis of Cost Accounting Variances

- A. Director labor and direct material
  - 1. Some causes of labor variances
  - 2. Material cost variances
  - 3. Areas of uncertainty
- B. Overhead
  - 1. Measures of volume
  - 2. Patterns of cost variation
  - 3. Cost line formula
  - 4. Budgeted costs
  - 5. Standard costs

  6. Absorbed costs
  7. Overhead variances
  8. Differences in selling costs

Division VII. Period Planning or Budgeting

- A. The budget
  - 1. Type of budgets
  - 2. The budget process
- B. The break-even chart
  - 1. Construction of a break-even chart
  - 2. Interpretation of a break-even chart

Division VIII. Project Planning: Relevant Costs

- A. Basic premise: profit maximization
- B. General approach
- C. Problem definition and alternative solutions
- D. Quantitative factors
- E. Future costs
- F. Differential costs
- G. Mechanics of the calculation
- H. The margin of error
- I. Evaluating and weighing the unmeasured factors

Texts and References

Anthony. *Management Accounting: Text and Cases*

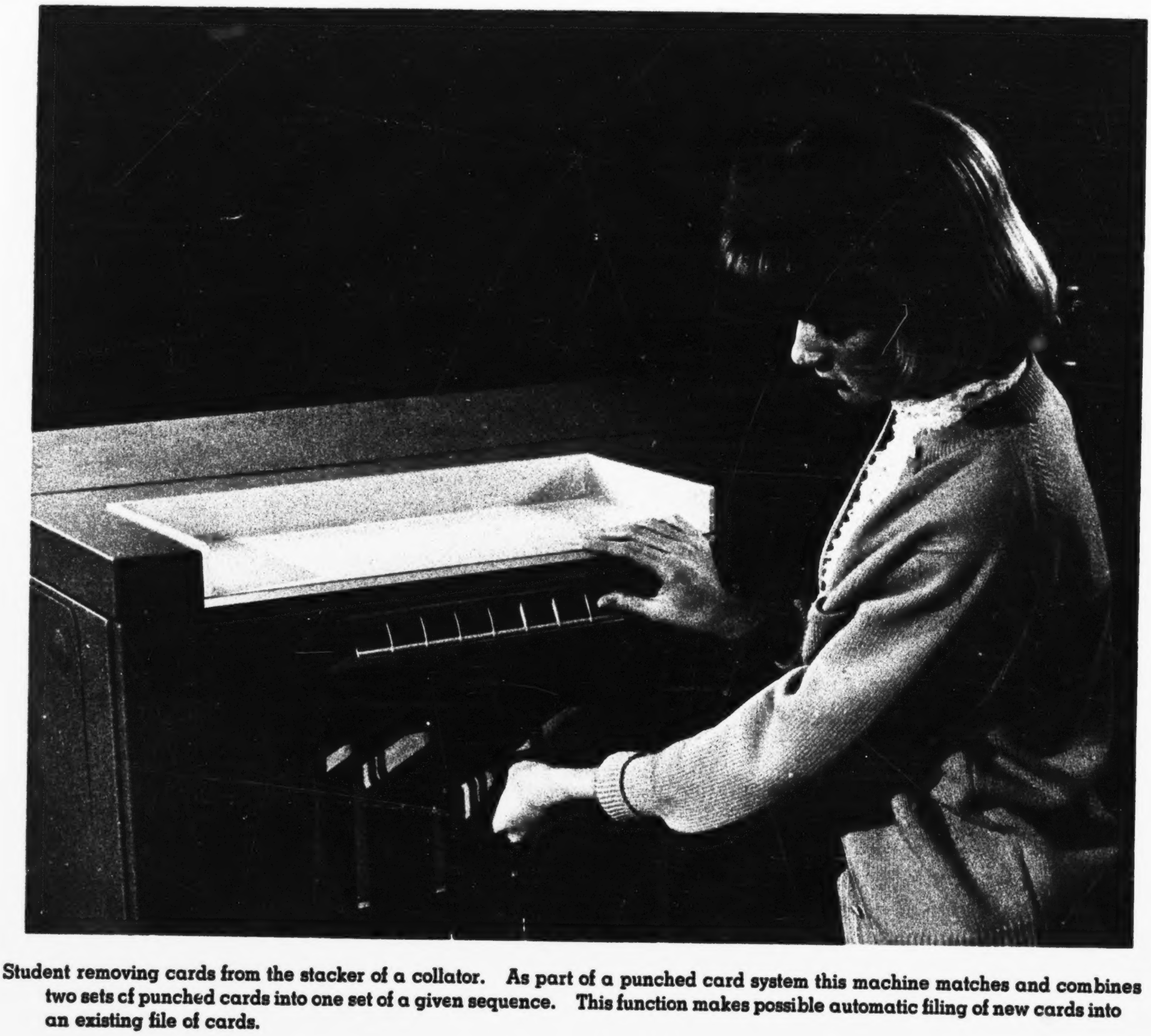
Finney. *Principles of Accounting: Introduction*

Holmes, Maynard, Edwards, *and* Meier, *Elementary Accounting*

——— *Intermediate Accounting*

Malchman *and* Slavin. *Foundations of Accounting for Managerial Control*

Rankin. *What's Behind a Financial Statement*



Student removing cards from the stacker of a collator. As part of a punched card system this machine matches and combines two sets of punched cards into one set of a given sequence. This function makes possible automatic filing of new cards into an existing file of cards.

G 123, Communication Skills II

Hours Required

Class, 3; Laboratory, 0

Description

The nature and dynamics of communication are continued in this course. The fundamental concepts treated here have important implications for organizations of all types—business, industrial, Government, military, social, public, and civic. This course is devoted to the practical uses of the communication process within the business organization and, in particular, within the data processing department.

Major Divisions

I. Dynamics of Communication
II. Qualities of Communication
III. Functions of Communication
IV. Methods of Communication
V. The Report Form

Division I. Dynamics of Communication

- A. Nature of people
  - 1. Beliefs and motivation
  - 2. Alone
  - 3. Interaction
  - 4. In groups
  - 5. In organizations
- B. Nature of communication
  - 1. What it is
  - 2. The events, elements, sequence of communication
  - 3. Communication control
  - 4. Occasions of communication

Division II. Qualities of Communication

- A. Communicating effectively
- B. Communicating efficiently
- C. Communicating clearly

Division III. Functions of Communication

- A. Information
  - 1. Scope of information communication
  - 2. Uses of information
  - 3. Exchange of information
- B. Evaluation
  - 1. Basis of evaluation
  - 2. Content of evaluation
  - 3. Manner of evaluation
- C. Instructive
  - 1. Instructions and procedures
  - 2. Training
  - 3. Direction, implementation, and communication
- D. Influence and persuasion
  - 1. The nature of influence
  - 2. Leadership and influence
  - 3. Influence, decision, and expectation
  - 4. Process and techniques of persuasion
  - 5. Ethics of persuasion and influence
  - 6. Communication and influence
- E. Other functions of communication

Division IV. Methods of Communication

- A. Tools and techniques
  - 1. Thinking and communication
  - 2. Observing, reading, and listening
  - 3. Skill in receiving
  - 4. Communication tools
  - 5. Functional English
  - 6. Interest and attention
- B. Preparation, presentation, and adaptation
- C. Forms and media of communication

Division V. The Report Form

- A. Characteristics of the report
- B. Report functions
- C. Informal reports
  - 1. Short-form reports
    - a. Memorandum reports
    - b. Business letter reports
    - c. Outline reports
- D. The formal report
  - 1. Arrangement
    - a. Cover and title page
    - b. Table of contents
    - c. Summary of abstracts
    - d. Body of the report
    - e. Bibliography and appendix
    - f. Graphs and drawings
  - 2. Preparation
    - a. Collecting, selecting, and arranging material
    - b. Writing and revising the report

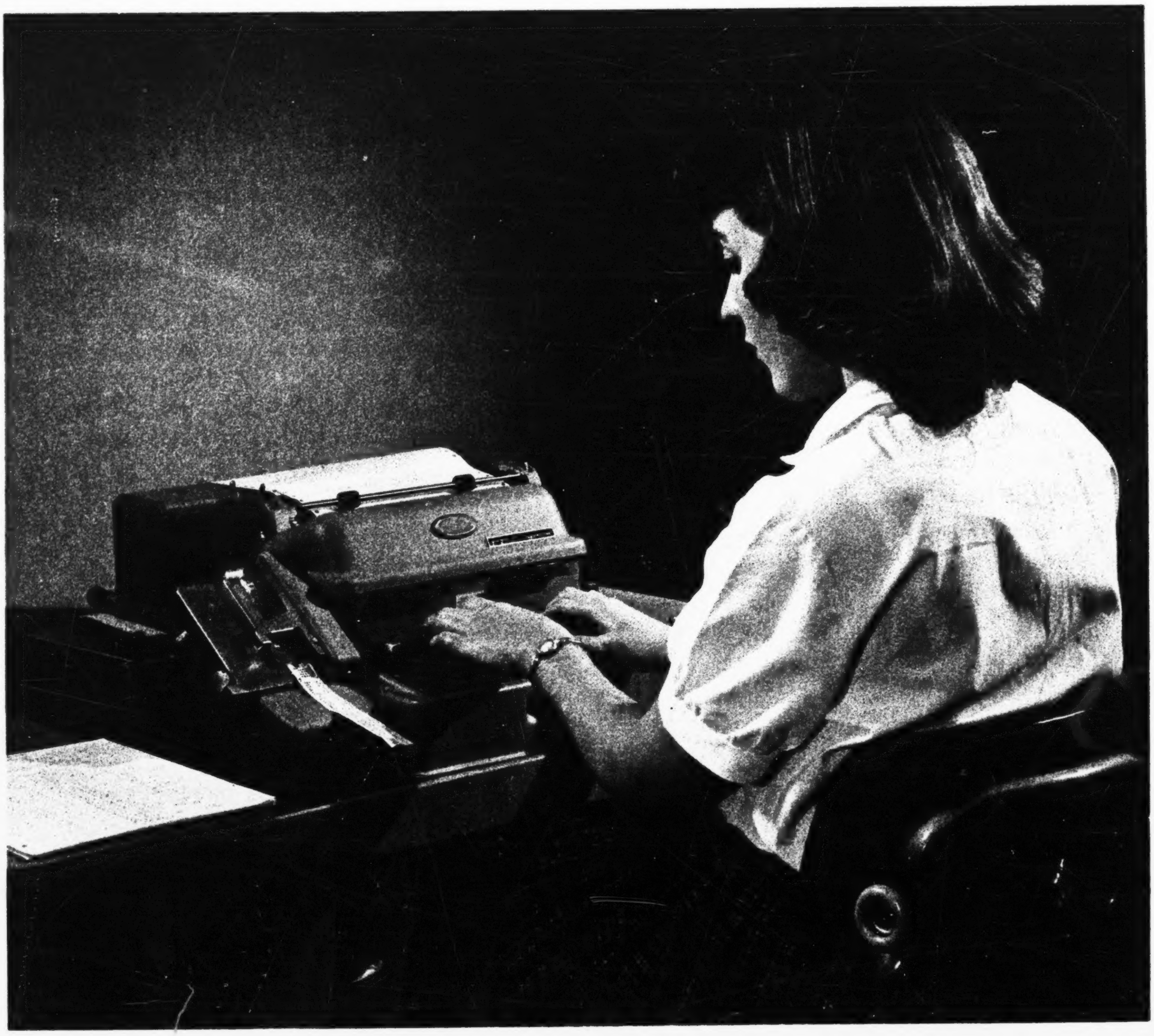
E. Special types of papers
  1. The abstract
  2. Process explanations
  3. The case history
  4. The book review

Texts and References

MERRIHUE. *Managing by Communication*

THAYER. *Administrative Communication*

See also texts and references listed for course G 113, *Communication Skills I* (p. 11)



A student operates a Flexowriter. This machine is key-driven and produces printed reports and punched paper tape.

COURSE OUTLINES: SECOND YEAR, FIRST SEMESTER

C 215, Computer Programing II

Hours Required

Class, 3; Laboratory, 5

Description

This is a continuation of the C–124 *Computer Programing I* course (See p. 16). The principles presented in the second semester course of the first year will be employed repeatedly in course II. Programing the tape data processing system will be taught as well as the fundamentals of random access programing.

Major Divisions

I. Subroutines
II. Programing a Tape System
III. Macro-Programing
IV. Job Timing
V. Programing a Random Access Device
VI. Program Testing

Division I. Subroutine

A. Library concept
B. Open subroutine
C. Closed subroutine

Division II. Programing a Tape System

A. Magentic tape characteristics
    1. Coding
    2. Checking
    3. Function
    4. Speed
B. Magnetic tape file organization
    1. Logical record
    2. Tape record
    3. Grouped records
    4. Segmented records
    5. Tape reel
    6. Tape file
C. Instructions
D. End-of-reel, file, job routines
E. Timing individual tape operations
F. The medium-scale tape system in support of a large-scale data processing system
    1. Pre-edit
    2. Peripheral operations
        a. Card to tape
        b. Tape to card
        c. Tape to printer
    3. File maintenance

Division III. Macro-Programing

A. Macro-instruction concept
    1. Advantages
    2. Application
B. Medium-level programing system
C. Use of library macros
D. Creation of macros

Division IV. Job Timing

A. Gross timing: timing the job
    1. Computing document throughout for the card system
    2. Timing a tape-oriented job
B. Timing the individual program steps

Division V. Programing a Random Access Device

A. Random access characteristics
    1. Coding
    2. Checking
    3. Function
    4. Speed
    5. Application
B. Random access file organization
C. Instructions
D. File loading routines
E. File dumping procedures
F. Timing random access operations
G. Inquiry station

Division VI. Program Testing

A. Program listings
B. Test data
C. Operating instructions
D. Checklists
E. Precalculated answers
F. Desk checking
G. Debugging techniques
H. Test team organization

References

All manufacturers' technical manuals

See Texts and References, listed for course C 124, *Computer Programing I* (p. 16)

C 213, Programing Systems

Hours Required

Class, 3; Laboratory, 1

Description

This introduction to programing systems will familiarize the student with the purpose and function of the various types of systems.

Major Divisions

- I. Basic Concepts
- II. Assembly Programs and Compilers
- III. Macro Generators
- IV. Report Generators
- V. Utility Programs
- VI. Data Scheduling Systems
- VII. Sort-Merge
- VIII. Monitors
- IX. High-Level Languages

DIVISION I. Basic Concepts

- A. The language
- B. The processor
- C. Advantages—disadvantages

DIVISION II. Assembly Programs and Compilers

- A. Concept
- B. Brief introduction to a specific programing system
- C. Need for high-level systems
- D. Application areas

DIVISION III. Macro Generators

- A. Need, functions, and uses
- B. Examples

DIVISION IV. Report Generators

- A. Concept
- B. Examples in the medium-scale computer area
- C. Examples in the large-scale computer area
- D. Scope of report generators

DIVISION V. Utility Programs

- A. Generalized routine concept
- B. "Load and Go" concept
- C. Examples

DIVISION VI. Data Scheduling Systems

- A. Tape area
  - 1. Scheduling function
  - 2. Blocking-deblocking function
  - 3. Error correction function
  - 4. End of operation functions
  - 5. Tape labeling functions
  - 6. Checkpoint and restart functions
- B. Disc file area

DIVISION VII. Sort-Merge

- A. Internal sort
- B. Merge

DIVISION VIII. Monitors

- A. Concept
- B. Application areas
- C. Example

DIVISION IX. High-Level Languages

- A. COBOL
  - 1. Procedure statements
  - 2. Data specification
- B. FORTRAN

Texts and References

Manufacturers' manuals covering each system outlined

Automatic Programing: Fact or Fancy. *Management and Business Automation*, February 1959

Automatic Programing—What Does It Offer, How Does It Work? *Office Management*, August 1959

Automatic Programing Systems. *Communication of ACM*, May 1959

Why Automatic Programing? *Computing News*, June 15, 1959

A 243, Statistics

Hours Required

Class, 4; Laboratory, 0

Description

The objectives of this course are to acquaint the student with the theory of statistics and its application in business today. The student will gain an understanding of the kinds of regularity that exist among random fluctuations. He will obtain experience in associating and using mathematical models to interpret physical phenomena and predicting, with reasonable certainty, the outcomes of experiments related to practical business problems. There will be practical experiences in the statistical solution of business problems through the use of computers. Methods of organizing and presenting data with intelligent interpretations are emphasized throughout the course.

Major Divisions

I. The Field of Statistics
II. Elementary Number Usage Techniques
III. Probability
IV. Principles of Sampling
V. Sampling Methods in Auditing
VI. Bivariate Data and Regression Analysis
VII. Correlation and the Analysis of Variance
VIII. Statistical Quality Control in Production and Management
IX. Statistical Analysis of Time Series Data
X. Index Numbers
XI. Forecasting and Market Research

DIVISION I. The Field of Statistics

A. What is statistics?
B. Applications of statistics
C. Growth of statistics in business data processing

DIVISION II. Elementary Number Usage Techniques

A. Organizing univariate data
B. Averages
  1. The arithmetic mean
  2. The median
  3. The mode
  4. Graphic representation of averages
  5. Use of averages
C. Measures of variation
  1. The range
  2. Variance and the standard deviation
D. Rounding
E. Significant digits
  1. Rules
  2. Use of rules
F. Cases

DIVISION III. Probability

A. Discrete and continuous probability distributions
B. Binomial and poisson distributions
C. Normal distributions
D. "*t*" distributions
E. Random variables
F. Probability tables

DIVISION IV. Principles of Sampling

A. Random selection in scientific sampling
B. The central limit theorem
C. The standard error of the mean
D. The statement of reliability
E. Statistical inference

DIVISION V. Sampling Methods in Auditing

A. Control of clerical errors
B. Sampling of physical property
C. Application to accounting records
D. Sampling plans in an audit test
E. How much to sample
F. Discovery sampling

DIVISION VI. Bivariate Data and Regression Analysis

A. The scutter diagram and stereogram
B. The line regression or estimation
C. The least square method in linear prediction
D. Confidence intervals in regression analysis
E. Regression analysis in economics and business problems

DIVISION VII. Correlation and the Analysis of Variance

A. Measuring the degree of correlation
B. Coefficients of correlation

- C. Correlation tables
- D. Multiple relations
- E. Analysis of variance: the one-way classification

Division VIII. Statistical Quality Control in Production and Management

- A. Statistical surveillance of repetitive processes
- B. Manufacturing process control
- C. Control charts for variables
- D. Control charts for attributes
- E. Sampling plans
- F. Risks in quality control

Division IX. Statistical Analysis of Time Series Data

- A. Components of time series
- B. Additive and multiplicative time series models
- C. Moving averages
- D. Time series analysis and forecasting

Division X. Index Numbers

- A. Statistical methods in index number construction
- B. Measurement of price and quantity charges
- C. Consumer price index
- D. Industrial production index
- E. Statistical tests for index numbers

Division XI. Forecasting and Market Research

- A. Forecasting techniques
- B. Econometric methods
- C. Input-output analysis
- D. Market and distribution research
- E. Survey of consumer buying plans

Texts and References

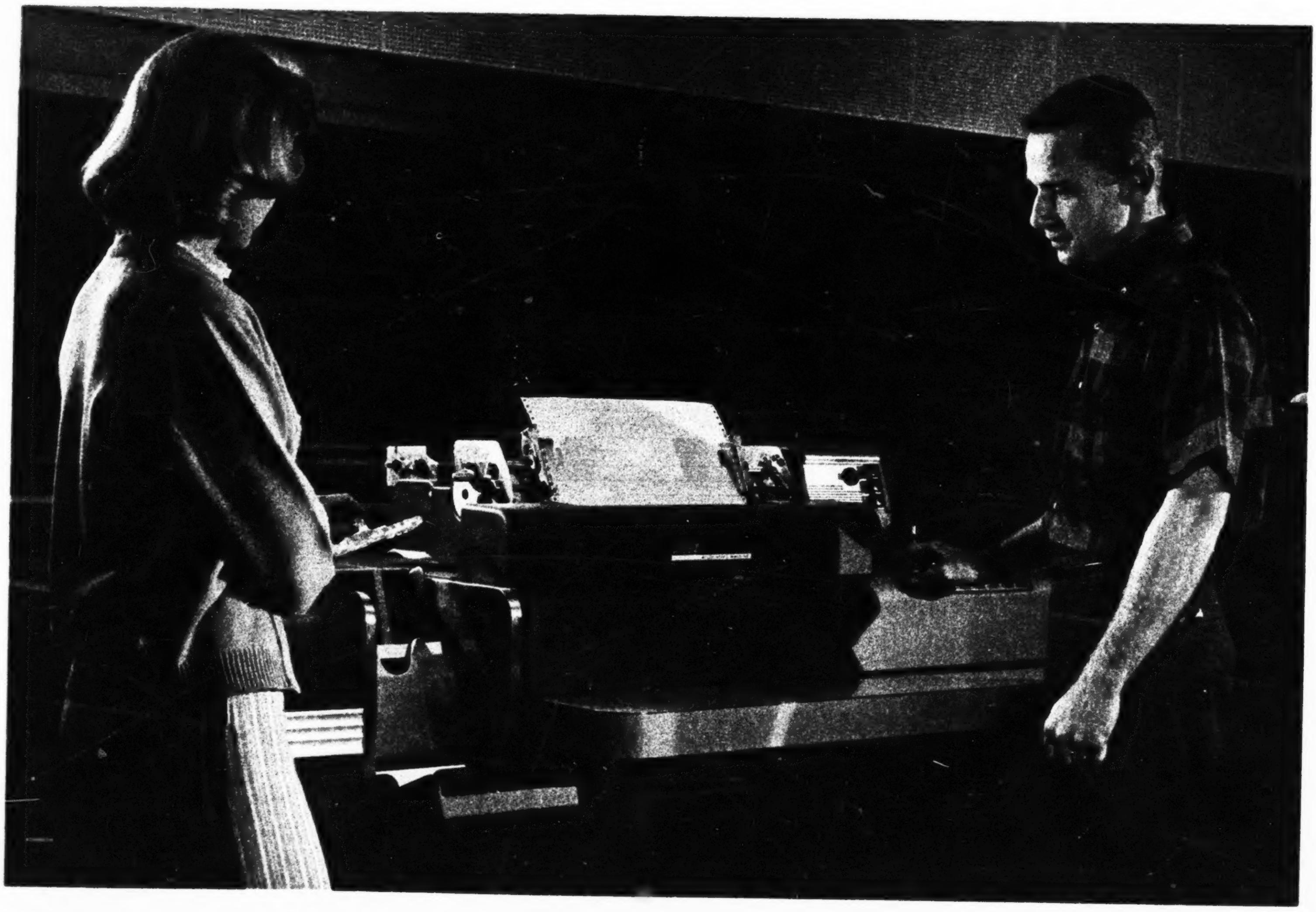
Croxton *and* Cowden. *Applied General Statistics*

Griffen. *Statistics Methods and Applications*

Mode. *Elements of Statistics*

Mosteller, Rourke, *and* Thomas. *Probability and Statistics*

Wallis *and* Roberts. *Statistics: A New Approach*



Students observe an accounting machine in operation. This machine prints alphabetical and numerical data from punched cards and totals data by proper classifications.

A 253, Business Organization

Hours Required

Class, 2; Laboratory, 0

Description

The purpose of this course is to familiarize the student with the concepts and structure of American business. The data processing programer, although specificially concerned with one phase of a business at a time, must have the perspective of the whole structure and understand the importance of the interrelationships of the parts of the entire organization.

Major Divisions

I. Types of Business
II. Beginning of a Corporation
III. Organization Levels
IV. Departments in a Business
V. Financing the Business

Division I. Types of Business

A. Definition of business
B. Single proprietorship
C. Partnership
D. Company
E. Corporation

Division II. The Beginning of a Corporation

A. Partnership to company
B. Company to corporation
C. Mergers

Division III. Organization Levels

A. Administration
  1. Stockholders
  2. Board
B. Management
C. Operating
D. Line concept
E. Staff concept

Division IV. Departments in a Business

A. Sales or marketing organization
B. Purchasing
C. Production
D. Research
E. Accounting
F. Personnel

Division V. Financing the Business

A. Stocks
B. Bonds
C. Reinvested earnings

Texts and References

AMRINE, *and others. Manufacturing Organization and Management*

BETHEL, ATWATER, SMITH, *and* STACKMAN. *Industrial Organization and Management*

DURAND. *Business: Its Organization, Management, and Responsibilities*

KELLEY *and* LAWYER. *How to Organize and Operate a Small Business*

SHILT *and* WILSON. *Business Principles and Management*

TONNE *and* MCGILL. *Business Principles, Organization, and Management*

A 263, Cost Accounting

Hours Required

Class, 3; Laboratory, 0

Description

An understanding of the basic concept of the cost accounting function within a manufacturing organization is the objective of this course. Material costs, labor costs, manufacturing overhead, and marketing costs that enter the cost accounting system are treated in detail. The use of the computer as a tool for performing the cost accounting function through the collection, processing, and interpretation of these data for providing management with pertinent facts about its business is stressed through case studies selected to illustrate the objectives of the cost accounting system, its relationship to the overall accounting system, and its uses to management.

Major Divisions

I. Essentials of Cost Accounting
II. The Income Statement of Manufacturing Companies
III. Cost Accounting Structures
IV. Case Studies: Design of Computer Cost Accounting Systems

DIVISION I. Essentials of Cost Accounting

A. Problems of cost determination
  1. Allocated elements
    a. Assets and time
    b. Function or responsibility
    c. Price level changes
B. Uses of cost information
  1. Reporting company status and progress
  2. Planning
  3. Control
  4. The balance sheet and income statement
C. Cost accounting and financial accounting
  1. Cost accounting as a part of the complete accounting structure
  2. Rules, tools, and techniques
D. Elements of cost
  1. Selling or distribution
  2. General and administrative
  3. Financial or nonoperating
  4. Product cost for inventory valuation
  5. Period costs

DIVISION II. The Income Statement of Manufacturing Companies.

A. Accounting for the cost of goods sold
  1. Raw materials
  2. Direct labor
  3. Manufacturing overhead: product costs and period costs
  4. Goods, or work, in process
  5. Finished goods
B. Variations in practice
  1. Condensed closing process
  2. Expanded closing process
C. Significance of the process
D. Cases

DIVISION III. Cost Accounting Structures

A. Account flow chart
B. Basic structure
C. Job costing and process costing
D. Standard costs
E. Variations in practice
F. Summary

DIVISION IV. Case Studies: Design of Computer Cost Accounting Systems.

A. Custom design manufacturing
B. Standard design manufacturing
C. Parts and subassemblies
D. Job costing
E. Process costing
F. Standard costing

Texts and References

ANTHONY. *Management Accounting: Text and Cases*
NEUNER. *Cost Accounting: Principles and Practice*
SHERWOOD *and* CHACE. *Principles of Cost Accounting*
SPECTHRIE. *Basic Cost Accounting*
——— *Industrial Accounting: A Brief Course*

COURSE OUTLINES: SECOND YEAR, SECOND SEMESTER

C 264, Business Systems Design and Development

Hours Required

Class, 3; Laboratory, 2

Description

The effective use of data processing equipment and management sciences in meeting the information needs of business requires that much skill and knowledge be applied to the development and design of data processing systems. The course is designed to guide the student through the three stages in the evolution of a system: Analysis of present information flow, system specifications and equipment selections, and implementation of the system.

The scope of a system development study will vary from a modest payroll procedure to the total information system of a large and complex business.

Major Divisions

I. The Approach
II. Requirements of the System
III. Developing the Solution
IV. Data Controls
V. System Controls
VI. System Evaluation
VII. Finalizing the System
VIII. System Implementation

Division I. The Approach

A. Application research
B. Problem definition
C. Scope of the study
D. Objectives
E. Desired results
F. Target dates and study phase responsibility
G. Education of serviced departments
H. Management's role

Division II. Requirements of the System

A. Fact-gathering techniques
  1. Interview
  2. Tabulation
B. Recording the facts
C. Reporting requirements
  1. Types of reports
  2. Report analysis
  3. Documentation
  4. Operating reports or documents
D. Source data requirements
  1. Report generating data
  2. Data documentation
  3. Format design and coding definitions
E. Analyzing the facts

Division III. Developing the Solution

A. General systems flow charting
  1. Standards
  2. Symbols
B. Decision tables
  1. Common elements
  2. Limited vs. extended entry
  3. Accuracy checks
C. Documentation
D. Presentation
E. Review

Division IV. Data Controls

A. Objectives
B. Data analysis
  1. Completeness
  2. Design suitability
  3. Mechanized transcription
C. Adjustments, corrections, and their control
D. Data control methods
E. Automatic and semiautomatic data entry methods and equipment

Division V. System Controls

A. The need
B. Standard techniques: machine-oriented
C. Unique techniques: application-oriented
D. Audit trails

Division VI. System Evaluation

A. Quality of results
B. Overall time cycle
C. Inherent advantages

- D. Cost factors
- E. The evaluation team
- F. Evaluation report
- G. Management approval and support

DIVISION VII. Finalizing the System

- A. Incorporating necessary changes
- B. Procedure writing
  - 1. Nature and extent
  - 2. Importance of clarity and conciseness
- C. Interdepartmental policy resolutions
  - 1. Coordination
  - 2. Approval
- D. Training manuals
- E. Detailed problem definitions
  - 1. Narrative
  - 2. Flow charts
  - 3. Record and report layouts
  - 4. Processing controls
  - 5. System controls
  - 6. Audit trails

DIVISION VIII. System Implementation

- A. Responsibility
  - 1. Staff
  - 2. Line
- B. Planning and coordination
  - 1. Plan of action
  - 2. Sequence of events timetable
  - 3. Scheduling
  - 4. Follow-up
- C. Training plans
- D. Progress reporting
- E. Assigning responsibility and follow-up
- F. Actual cut-over or conversion
  - 1. Timing
  - 2. Breaking-in period
  - 3. Parallel operations
- G. Rules and helpful hints for conducting a systems study
- H. Postinstallation evaluation
  - 1. Objectives
  - 2. Actual vs. anticipated costs
  - 3. Quality of resulting information
  - 4. Time schedules verification
  - 5. Modifications and refinements to the system
  - 6. Discontinue all replaced routines
  - 7. Subsequent reviews of the system

Texts and References

GRABBE, RAMO, *and* WOOLDRIDGE. *Handbook of Automation, Computation, and Control*

GREGORY *and* VANHORN. *Automatic Data Processing Systems*

LAZZARD. *Systems and Procedures*

MCCRACKEN, WEISS, *and* LEE. *Programing Business Computers*

C 266, Advanced Programing Systems

Hours Required

Class, 4; Laboratory, 4

Description

The objective of the course is to provide the student with sufficient knowledge of programing systems concepts so that he may easily master any specific system with a minimum of instruction. Furthermore, he will be qualified to analyze, evaluate, and make minor modifications to such systems. Individual phases of certain selected systems are treated in detail in order that the student may learn advanced programing and logic decision techniques as applied in sophisticated systems. The course is so designed that the student may gain an insight into the various functions of advanced programing systems and the manner in which they perform their tasks without learning the actual programing language of the various systems.

Major Divisions

I. Translators, Compiler, and Assemblers
II. Higher Level Language Processors
III. Macro-Generators
IV. Report Generators
V. Input-Output Control Systems
VI. Sorts-Merges
VII. Monitors and Supervisory Systems
VIII. Simulators

DIVISION I. Translators, Compiler, and Assemblers

A. Review of basic programing systems
B. Evolution of languages and processors
    1. Processors
    2. Source programs
    3. Languages
    4. Widely accepted languages and processors
    5. Mnemonics
    6. Automatic storage allocation
    7. Input-output problems
C. Cascade or modular approach to the development of programing systems
D. Assembly programs
    1. One-for-one translator
    2. Assign storage locations to symbols
    3. Actual machine operation codes for symbolic codes
    4. Knowledge of environment
    5. Relative addressing
    6. Constants and literals
    7. Subroutines
    8. Program debugging aids
    9. Pseudo-operations
    10. Sequence of operations: internal tables
E. Compilers
    1. One-to-many translator
    2. Source language statements
    3. Advantages and disadvantages
    4. Structure of compilers
    5. Analyzing statements
    6. Macro-generation
    7. Compiler tables
    8. Assembly programs within compilers

DIVISION II. Higher Level Language Processors

A. Two-phase translation process
    1. High-level to intermediate level translation
    2. Intermediate-level to machine language translation
B. COBOL processors
    1. Similarity among processors for different machines
    2. Differences among processors for different machines
    3. Vocabulary: source language
    4. Grammatical rules
    5. A practical exercise
C. Other high-level languages
    1. Inclusion of low-level language vocabularies
    2. Interchangeability of specific languages among processors: FORTRAN
    3. Translation without execution
    4. Translation and execution combined

DIVISION III. Generators

A. Macro-generators as an integral part of compilers
B. Logical structure of a macro statement. What is to be done, not how
C. Logical functions and data description

- D. Types of macros
    - 1. Substitution
    - 2. Free analysis
- E. The macro-generation phase of a compiler
- F. Advantages of macros
- G. The macro-generator library tape
- H. Lower leveling among macro-generators
- I. Adding macro-generators to a compiler library

DIVISION IV. Report Generators

- A. The report generator in the structure of compiler
- B. Report generator format
- C. Types of report generators
- D. Advantages and disadvantages
- E. Report generator phase of compilers
- F. Using the report generator
- G. Practical exercise

DIVISION V. Input-Output Control Systems

- A. Need for IOCS
- B. Historical development
- C. Advantages
- D. Input-output control systems features
    - 1. Scheduling asynchronous functions
    - 2. Blocked records manipulation
    - 3. Input-output error correction procedures
    - 4. End-of-reel, end-of-file procedures
    - 5. Input-output data control procedures
- E. System control techniques in IOCS
    - 1. Block check-sum
    - 2. Hash totals
    - 3. Block counts
    - 4. Sequence checking
- F. Tape labeling: internal reel identification
    - 1. Header labels
    - 2. Trailer labels
    - 3. Automatic checking and preparation
- G. Checkpoint and restart
- H. Hardware independence using IOCS
- I. Random access memory IOCS
- J. Standard steps of IOCS
    - 1. Input-output area definitions
    - 2. Overlapped or shared input-output areas
    - 3. Opening files
    - 4. Reading and writing of input-output data records
    - 5. Closing files at end of reel or end of job

DIVISION VI. Sorts-Merges

- A. The need for sorting and merging systems
- B. Sorting and merging as an integral part of a manufacturer's support program
- C. History and development of sort programs
- D. The assignment portion
- E. Phases of a sort program
    - 1. Phase I
        - a. Sequences or strings
        - b. Blocking factors
        - c. "Order" of the merge
        - d. Completion of the phase
    - 2. Phase II
        - a. Merging the sequences or strings
        - b. Types of merges
        - c. Effects of varying numbers of tape drives
    - 3. Phase III
        - a. Final merge pass
        - b. Making modifications in phase III
        - c. Summarizing, deleting, alternations etc., during phase III
- F. Internal sorting techniques
- G. Timing considerations
- H. Generalized vs. specific sorts
- I. A practical exercise

DIVISION VII. Monitors and Supervisory Systems

- A. Introduction
    - 1. Purpose of monitors and supervisory systems
    - 2. Typical systems
    - 3. Elements of a monitored system
    - 4. Principles of storage sharing and program control transfer
- B. Compilers, assemblers, translators
    - 1. Assembly of symbolic source programs
    - 2. Compiler error listings
    - 3. Program modifications
    - 4. Symbol and pseudo-operation error listings
    - 5. Program listings, remarks, comments
- C. Debugging systems
    - 1. General features
    - 2. Information macro-instructions
    - 3. Model macro-instructions
    - 4. Conditional macro-instructions
- D. Input-output system
    - 1. Editing
    - 2. Control cards
    - 3. Format statements
    - 4. Error analysis and messages
    - 5. Output editing
    - 6. Macro-instructions
- E. Transmission macros

- F. Buffering, routines
  - 1. Special purpose routines
  - 2. General purpose routines
  - 3. Dispatching routines
- G. Job decks
  - 1. Symbolic program decks
  - 2. Computer oriented language program decks
  - 3. Control cards
- H. Processing of job decks controlled by monitor
  - 1. Sequence of operations
  - 2. Error handling under monitor control
- I. Requirements for a tape system
- J. Requirements for a random access system

DIVISION VIII. Simulators

- A. Introduction
  - 1. Purpose of simulation
  - 2. Simulation as a management tool
  - 3. Practical simulation applications
- B. Local structure, system study
- C. General simulation output information
- D. Statistical variations
- E. Priority level evaluation and peak load effects
- F. Elements of a simulation program
- G. Symbolic notations and purposes
- H. Operating characteristics
- I. Summary

References

GRABBE, RAMO, *and* WOOLDRIDGE. *Handbook of Automation, Computation, and Control,* vols. 1 and 2.

Manufacturers' technical publications covering each system in this course

Student removes punched cards from a card sorter. This machine processes cards in a numerical or alphabetical sequence according to classification.

C 262, Data Processing Field Project

Hours required

Class, 1; Laboratory, 3

Description

Individual assignments in a carefully selected local data processing installation will be obtained during the fourth semester. The evaluation of the student's performance during this period will be a cooperative effort engaged in by local installation management and the vocational education staff. The primary purpose of this session is to give the student an overview of practical data processing. For additional discussion of the field project, *see* Appendix D.

Major Divisions

I. Machine Operation
II. Program Preparation
III. Program Documentation and Maintenance
IV. Error Detection and Restart Procedures
V. Installation Management
VI. Student Report

Division I. Machine Operation

The student will be given an opportunity to perform data processing production runs under supervision of the machine operator in a local installation. The sheer volume of data will quickly place in a proper perspective the academic principles gained in the first three semesters.

Division II. Program Preparation

The student will observe the data processing problem solution procedures employed by an operating programing and methods group. The student will be given concrete examples of the steps taken in problem definition, problem analysis, solution development, and solution application. This will serve as an indication of the scope of the student's forthcoming vocation. The student should be given a subroutine or a portion of a main routine to program during this period of assignment to an installation. The exercise must be carefully selected to insure that the task will not be too lengthy.

Division III. Program Documentation and Maintenance

The student will use established procedures for documenting problem solutions. Standards employed in accomplishing documentation will be reviewed. The importance of program maintenance and the problems associated therewith should be covered in detail with the student.

Division IV. Error Detection and Restart Procedures

The student will be given the opportunity to review a data protection system with control and error detection. He should become aware of the need for restart procedures necessitated by error detection or failure to meet a systems check.

Division V. Installation Management

The student should spend time with a data processing department manager reviewing the objects and functions of a technical manager. During this session, the student will observe the external devices used in controlling: data processing machine loading, scheduling, work flow, batching, and personnel planning.

Division VI. Student Report

The student will be required to prepare a formal report based on his experience in a local data processing installation. The purposes of the report are: (1) to serve as an example of report writing; and (2) to solidify the role of data processing by requiring the student to amalgamate his observations and experiences.

Reference

Gaum. *Report Writing*

G 263, Social Science

Hours required

Class, 3; Laboratory, 0

Description

The course is oriented to the proposition that each technician in a democracy has a responsibility to make a productive contribution toward the perfection and perpetuation of the American way of life; and that, to do so, he must know and understand his responsibilities and obligations to himself, his family, his community, his State and Nation, and the world. The salient elements of the four basic social sciences (psychology, sociology, economics, and government) are reviewed to help the student achieve a good working understanding of his total environment and the forces which interact to form the social setting in which he works and lives. Time allotments to the various elements within major divisions will depend upon the background of the class.

Major Divisions

I. General Psychology
II. Sociology
III. Economics
IV. American Government

DIVISION I. General Psychology

A. Basic human drives and motives
B. Heredity and environment
C. Psychology of decision-making
D. Group dynamics
  1. Conditions affecting group morale
  2. Forming opinions
E. Human relations
F. Principles of learning

DIVISION II. Sociology

A. Our culture: its improvement and perpetuation
B. Relationship of individuals to social institutions
  1. Home
  2. Public and private educational institutions
  3. The community
  4. Church
  5. Organized social groups: fraternal, labor, business, and professional
  6. Government
  7. Other
C. Forces of social disorganization, such as migration, crime, mobility, and subversive groups.

DIVISION III. Economics

A. Social, political, and economic forces responsible for the growth and development of industry and technology
  1. Pastoral stage
  2. Handicraft stage
  3. Machine stage
  4. Atomic stage
  5. Planned economy or laissez faire
B. Economic expressions
  1. Land, resources (human and natural), capital, management, and labor
  2. Economic goods
  3. Economic wealth
  4. Utility
  5. Other
C. Comparative economic systems
  1. Capitalism: free enterprise
  2. Socialism
  3. Communism
  4. Other
D. Labor problems and legislation
  1. Union policies and practices
    a. Wages, hours
    b. Closed shop
    c. Union shop
    d. Seniority
    e. Worker relationships
    f. Worker benefits: sickness, accident, other
  2. Industrial strife
    a. Strikes
    b. Boycott, lockout, slowdown, sabotage, picketing
    c. Mediation
  3. Labor legislation
    a. Taft-Hartley law
    b. Labor-Management Reporting and Disclosure Act of 1959

        - c. NLRB
        - d. Wage-hour board
        - e. Safety legislation
        - f. Minimum-wage law
        - g. Fair Employment Practices Acts
- E. Business law and management
    - 1. Types of organizations and legal aspects
        - a. Single ownership
        - b. Partnership
        - c. Corporation
        - d. Trusts and holding companies
        - e. Security and commodity exchanges
        - f. Public utilities
        - g. Marketing co-ops
        - h. Chattels and real estate
        - i. Savings and loan associations
    - 2. Our capitalistic system: private enterprise
        - a. Trust laws
        - b. Monopolies, franchises, fair trade
        - c. Banks and banking
            - (1) Bank insurance
            - (2) Discounting and loans
        - d. National income: sources
        - e. Gross national product
        - f. Personal income
        - g. Public debt: limits
        - h. Private debt: limits
        - i. Government grading and quality controls
    - 3. Finance, investment, and taxation
        - a. Investments and securities
        - b. Stocks and bonds
        - c. Monetary system
            - (1) Legal tender: coins, notes
            - (2) Federal Reserve System
            - (3) Fiat money
        - d. Credit buying: effects of interest rate
        - e. Taxation
            - (1) Income taxes
            - (2) Personal and real property taxes: assessment, evaluation, equalization, etc.
            - (3) Corporation taxes
            - (4) Capitation taxes
            - (5) Inheritance taxes
            - (6) Theories of shifting and incidence in taxation
            - (7) Sales tax
            - (8) Other
        - f. Insurance

DIVISION IV. American Government

- A. Constitutional bases for Federal, State, and local governmental relationships
    - 1. Federation—confederation
    - 2. Compact of States theory
- B. Political parties and pressure groups
    - 1. Nominating conventions and election campaigns
    - 2. Party discipline
    - 3. Lobbies and vested interest groups
    - 4. Other
- C. Organization and function of legislative branch
    - 1. Minority and majority floor leaders
    - 2. Whip
    - 3. Committee organizations
    - 4. Other
- D. Organization and function of executive branch
    - 1. Cabinet
    - 2. Executive staff and assistants
- E. The court system
    - 1. Federal courts
        - a. District
        - b. Appellate
        - c. Supreme
        - d. Special
    - 2. State courts
    - 3. Civil suits or actions
    - 4. Criminal actions
- F. Responsibilities of citizens in a democracy
    - 1. Understanding propaganda
    - 2. Becoming informed on public affairs
    - 3. Voting
    - 4. Running for office, etc.
    - 5. Public welfare
- G. International relations and world problems
    - 1. United Nations
    - 2. Treaties
    - 3. Mutual security pacts or agreements
    - 4. Alliances
    - 5. Current events
    - 6. Technical assistance, such as mutual aids in economics, agriculture, and education.

Texts and References

ALILUNAS. *Youth Faces American Citizenship*

AMIS. *Economics*

BERNHARDT. *Practical Psychology*

BIERSTEDT. *The Social Order*

BLODGETT *and* KEMMERER. *Comparative Economic Development*

BONE. *American Politics and the Party System*

BORGARDUS *and* LEWIS. *Social Life and Personality*

BRUER. *All About Me*

DODD. *Applied Economics: Elementary Principles of Economics Applied to Everyday Problems*

FOSTER. *Psychology for Life Adjustment*

GAVIN, GRAY, *and* GROVES. *Our Changing Social Order*

HAAS *and* WHITING. *Dynamics of International Relations*

JOHNSON. *Essentials of Psychology*

McCARTHY. *Rights of the American Worker*

MAGRUDER. *American Government*

MORGAN. *Introduction to Psychology*

MUELLER. *Money and Banking*

MUSGRAVE. *The Theory of Public Finance*

SCHNEIDER. *Industrial Sociology*

SELEKMAN. *Labor Relations and Human Relations*

STEINER. *Government's Role in Economic Life*

YOUNG. *Understanding Labor Problems*

Student operating an alpha-numeric printing card punch. This machine provides the basic method of converting service data into punched cards.

Appendix A

BIBLIOGRAPHY

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Appendix B

AUDIOVISUAL AIDS

KEY:
- **A INTRODUCTION TO DATA PROCESSING**
- **B ELECTRIC ACCOUNTING MACHINES**
- **C DATA PROCESSING MATHEMATICS**
- **D COMPUTER PROGRAMING**
- **E BUSINESS SYSTEM DESIGNS AND DEVELOPMENT**

Film Strips and Sound Tapes

	Course
AMERICAN MANAGEMENT ASSOCIATION, 1515 Broadway, New York 36, N.Y.:	
Data and Decision: four parts, color, sound	A, D, E
Operations Research: three parts, color, sound	E
BURROUGHS CORPORATION, 6071 2d Ave., Detroit 32, Mich. (or nearest branch office):	
The Beauty of It (savings and loan applications): 35 mm., color, sound, 30 mins	A, B, E
COBOL (produced by Westinghouse): 35 mm., color sound, 20 mins	A, D
Control Input for ADP: 35 mm, color, sound, 27 mins	A, B, E
Cure for Dataphobia (mechanization for doctors and clinics): 35 mm., color, sound, 18 mins	A, B, E
Data for Diagnosis (hospital accounting): 35 mm., color, sound, 22 mins	A, B, E
Design for Throughput (B200): 35 mm., color, sound, 17 mins	A, E
On the Road to Decision (auto dealer accounting): 35 mm., color, sound, 20 mins	A, B, E
The Open Road (auto dealer accounting): 35 mm., color, sound, 20 mins	A, B, E
Serving Through Better Systems (CPA accounting systems): 35 mm., color, sound, 17 mins	A, B, E
They Pay Their Way (banking applications): 35 mm., color, sound, 20 mins	A, B, E
This Business of Education (school accounting): 35 mm., color, sound, 18 mins	A, B, E
To Bridge the Gap (control and conversion): 35 mm., color, sound, 18 mins	A, B, E
Your Investment in Inventory (inventory accounting): 35 mm., color, sound, 20 mins	A, B, E
CRESAP, MCCORMICK & PAGET, 342 Madison Ave., New York 17, N.Y.:	
An Introduction to Electronic Data Processing: slidefilm, 1½ hrs	A, D
ERNST & ERNST, 120 Broadway, New York 5, N.Y.:	
Electronic Computing Equipment: slidefilm, 2 to 3 hrs	A, C
IBM CORPORATION, Film & TV News Activities, 590 Madison Avenue, New York 22, N.Y.:	
1001 Data Transmission System: 35 mm., color, sound tape	A, E
1401 Data Processing System: 35 mm., color, sound tape	A, D
1418 Optical Character Reader: 35 mm., color	A, D
1620 Data Processing System: 35 mm., color, sound	A, D
Consolidated Functions in Ordinary Life Insurance: 35 mm., color, sound	A, D
Data Processing for Banks: 35 mm., color, sound	A, E
Data Processing for Savings and Loan Associations: 35 mm., color, sound	A, E
Data Processing for the Wholesale Drug Industry: 35 mm., color, sound	A, E
Distribution Accounting: 35 mm., color, sound	A, C, E
The Educated Computer: 35 mm., color, sound	D, E
Education in Action: 35 mm., color, sound	A, E
Fire and Casualty Agency Accounting: 35 mm., color, sound	A, D
Further Steps in Mechanization: 35 mm., color, sound	A, E
Hospital Accounting: 35 mm., color, sound	A, D
IBM 1410 Data Processing Systems: 35 mm., color, sound	A, D
IBM 7074 Data Processing Systems: 35 mm., color, sound	A, D
IBM Datacenters: 35 mm., color, sound	E
Installation of Unit Record Equipment: 35 mm., color, sound	A, B
Job Shop Simulation	A, D
The Magic Window—Principles of Punched Card Accounting: 35 mm., color, sound	A, B

Course

Management Science: 35 mm., color, sound..... D, E

Manufacturing Control: 35 mm., color, sound..... A, E

New Power for Numerical Control: 35 mm., color, sound..... A, D

Principles of Electronic Data Processing: 35 mm., color, sound..... A, D

Public Utility Engineering: 35 mm., color, sound..... A, C

Rent or Buy: 35 mm., color, sound..... A, E

Retail Accounts Receivable: 35 mm., color, sound..... A, E

Sales Forecasting: 35 mm., color, sound..... A, E

Service to Local Government: 35 mm., color, sound..... A, E

Service to Schools: 35 mm., color, sound..... A, E

Time for Management of Men, Material, Money..... A, D

Time To Grow—Installation of Systems Equipment: 35 mm., color, sound..... A, E

Remington Rand Corporation, Audio Visual Aids Department, 315 Park Ave., South, New York 10, N.Y.:

The 1004, VA U 3551: 35 mm., sound, color, 12 mins., 1962..... A, B, E

Operations Research, AMA VA U 2830, 3 parts, 35 mm., color, sound, 52 mins..... E

In basic business language this set of filmstrips examines the aims, analytical tools, results, and limitations of this management technique.

Part I. *Operations Research—What It Is:* 17 mins.

Traces the development of OR from its inception during World War II to its present uses in business and industry, to provide management with a better, more objective basis for making decisions.

Part II. *Operations Research—How It Works:* 22 mins.

Shows in a step-by-step illustration how OR is applied to two specific problems representative of the broad range of problems OR can handle.

Part III. *Scope and Limitations:* 13 mins.

Demonstrates how the OR team defines the problem, selects the appropriate measure of effectiveness, and collects the essential data required for the more complex problems.

Public Utilities Accounting, VA U 2256: 35 mm., color, sound, 14 mins., 1960..... A, B, E

Using the Public Utility *1924 Report on Customer Accounting Practices and Policies* as a basis, briefly surveys the evolution of data processing in utilities from 1946 to 1958; cites the problems realized and how in 1958 Univac Card-Punching Printer revolutionized utility customer billing operations; highlights the many applications and processing advantages offered to utilities by combining the Card-Punching Printer with the UNIVAC Solid-State Computer. Stresses solid-state flexibility and capability.

This Business of Numbers, VA U 1201 Rev. I: 35 mm., color, sound, 20 mins., 1960..... A, C

From the caveman to the modern scientist, arithmetic is traced with amusing cartoons from its beginnings to modern data processing systems.

Course

UNA and the Univac, VA U 2013: 35 mm., color, sound, 16 mins., 1960..... A, B, C

A basic interpretation of data processing from punched cards, through the Babbage Analytical Engine, to today's computers, showing how a computer such as UNA handles a routine inventory problem, thereby freeing clerical workers for more creative and productive tasks. Cites broad use of computers including weather forecasting, space research, engineering, and medicine.

Motion Picture Films

Burroughs Corporation, 6071 2d Ave., Detroit, Mich. (or nearest branch office).

Electronic Bank Bookkeeping on the Job: 16 mm., color, sound, 12 mins..... A, B, E

F-2000 Computer: 16 mm., color, sound, 18 mins..... A, E

The First Alert (ALRI): 16 mm., color, sound, 15 mins..... A

Highway to Infinity (ATLAS Guidance Computer): 16 mm., color, sound, 18 mins..... General

Mark of Computence: 16 mm., color, sound, 20 mins..... General

More Than Miraculous (MICR Input): 16 mm., color, sound, 23 mins..... A, E

Pilot for Atlas (ATLAS Ground Guidance Computer): 16 mm., color, sound, 5 mins..... A

The Power To Serve: 16 mm., color, sound 27 mins..... General

Program for Progress: 16 mm., color, sound, 27 mins..... A

Eastman Kodak Company, Department 8-TR, 343 State St., Rochester, N.Y.:

You're on the Team: 16 mm., color, sound, 20 mins.

General Precision, 1680 Wisconsin Avenue NW., Washington 7, D.C.; or Commercial Computer Division, 101 West Alameda Ave., Burbank, Calif.; or Commercial Computer Division, 6511 Oakton St., Morton Grove, Ill.:

P.I.N.T.: 16 mm., black and white, sound, 50 mins..... D

Instructional film on programing.

R.P.C. 4000: 16 mm., color, sound, 20 mins..... A, D

Description of the "4000" Computer.

IBM Corporation, Film and TV News Activities, 590 Madison Avenue, New York 22, N.Y.:

Automatic Computers: 16 mm., black and white, 30 mins..... A, D

The Bank: 16 mm., sound, color, 19 mins..... A, D

The Cards That Count: 16 mm., sound, color, 15 mins..... A, B

City at Night—Mathematics Exhibit: 16 mm., sound, black and white, 45 mins..... C

Costs That Make Sense: 16 mm., sound, color, 15 mins..... A, D

The Disks That Are Cylinder: 16 mm., sound, color, 11 mins..... A, D

Course

The IBM 1404 Printer: 16 mm., sound, color, 8 mins. .... A, D

The IBM 1438 Alphametric Optical Reader: 16 mm., sound, color, 11 mins. .... A, D

IBM Research Presents a Progress Report on Language Translation Equipment: 16 mm., sound, black and white, 4 mins. .... E

Information Retrieval: 16 mm., sound, color, 18 mins. .... E

Insurance Information Bulletin #1: 16 mm., sound, color, 12 mins. .... A, D

Introduction to Feedback: 16 mm., sound, color, 12 mins. .... E

Man Into Space: 16 mm. or 35 mm., color, 8 mins. .... D

Mathematical Peep Shows: 16 mm., sound, color, 13 mins. C

A Moon Is Born: 16 mm., sound, color, 4 mins. .... E

The Next Step: 16 mm., sound, color, 15 mins. .... A, D

No Margin for Error: 16 mm., sound, black and white, 5 mins. .... A, E

The Question Tree: 16 mm., sound, color, 13 mins. .... E

The Report Generator: 16 mm., sound, color, 9 mins. .... D

Merit Production Inc. of California, 441 South Beverley Drive, Beverley Hills, Calif.:

Breakthrough: 16 mm., color, 35 mins. .... D, E

McGraw-Hill Book Company, Text-Film Department, 330 West 42d St., New York 36, N.Y.:

See It Now—Automation: 16 mm., black and white, 90 mins. .... A, D

National Office Management Association, Willow Grove, Pa.:

Integrated Data Processing: 16 mm., sound .... A, E

Radio Corporation of America, EDP Division, Government Marketing Office, 1725 K St. NW., Washington 6, D.C.:

Demonstration of RCA 501 EDP System: 16 mm., color, sound, 15 mins. .... A, D

Space Age Administration: 16 mm., color, sound, 20 mins. .... A, D

Remington Rand Univac, Audio-Visual Aids Department, 315 Park Ave. South, New York 10, N.Y.:

Census '60, VA U 2012: 16 mm., black and white, sound, 13 mins., 1960 .... A, E

An explanation of why and how U.S. Census data is collected, compiled, and evaluated using FOSDIC (Film Optical Sensing Device for Input to Computers) and the UNIVAC 1105 Scientific Computer.

Course

Decisions, Decisions, Decisions, VA U 2345: 16 mm., sound, black and white, 12 mins., 1960 .... A, E

A description of simulations, or "games," using the UNIVAC I at Franklin Institute, Philadelphia, Pa. The film, made during an actual "play," summarizes the objectives, goals, and results, tangible as well as formulative, realized by the participants.

The Eastern Air Lines 490 Real-Time System: 16 mm., black and white, sound, 4 mins., 1962 .... A, E

Brief presentation of Eastern Air Lines 490 Real-Time Reservation System in operation at the Charlotte, N.C., central site.

Months Into Minutes, VA U 1442: 16 mm., sound, color, 10 mins., 1958 .... A, E

An introduction to the units and operation of the UNIVAC 1103 Scientific Computer, highlighting oil, utility, and National Defense applications.

No Time for Cookie Jars, VA U 1402: 16 mm., sound, color, 20 mins., 1957 .... A, E

Prefaced with a brief cartoon history of toll road accounting, this film presents up-to-date machines and methods for collection of tolls for both carrier and interchange toll systems. Featured machines are the Synchro-Matic, the Alphabetical Tabulator, UNIVAC 120, and UNIVAC File Computer.

Numerical Control—Solid-State, VA U 3177: 16 mm., sound, color, 10 mins., 1961 .... A, E

A demonstration of automatically controlled machine tools used in the manufacture of metal parts for the aircraft industry. Shows how the UNIVAC Solid-State Computer prepares control media for machine tools making it possible to fabricate highly complex parts faster and more economically than could be done with conventional tooling methods.

Sights and Sounds of Progress, VA U 3181: 16 mm., sound, color, 23 mins., 1961 .... A, D, E

A summary of advancements during 1961 in engineering, research, facilities, and new products of the Sperry Rand Corporation.

Then and Now, VA U 3236: 16 mm., color, sound, 12 mins., 1961 .... A, E

An account of the development of ENIAC, the first electronic computer, by J. Prosper Eckert and John W. Mauchly, co-inventors of the system. Following their account of ENIAC, they discuss their current interests and activities.

Truck Route to Better Records, VA U 1670: 16 mm., black and white, sound, 17 mins., 1960 .... A, B, E

The "Z Line" realizes its records do not offer adequate information for sound management decisions. The investigation of other trucking firm methods and procedures reveals punched card installations ranging from the basic to those using the UNIVAC 60 and Solid-State Computers.

Advantages in areas such as payroll, interline data, maintenance, sales commissions, billing accounts receivable, and ICC reports are pointed out. Simplicity, speed, and accuracy are stressed as vital points in an effective accounting system.

	Course
What Do You Want? VA U 1736: 16 mm., sound, color, 20 mins., 1960	A, E

Traces the development of electronic computers from ENIAC to UNIVAC III. Emphasizes how UNIVAC, backed by the resources of Sperry Rand, pioneered and will continue to be a leader in the development and production of computing systems. J. P. Eckert, co-inventor of the first digital computer, gives a glimpse at the computers of the future, exploring such areas as speed, storage, and application.

Overhead Projector Foils

IBM Corporation Films and TV News Activities, 590 Madison Avenue, New York 22, N.Y.:

	Course
Tape-Controlled Carriages, #922, 923—4 foils	B
77 Collator—7 foils	B
305 Ramac—21 foils	C
402–403 Accounting Machine—15 foils	B
407 Accounting Machine—10 foils	B
519 Document-Originating Machine—5 foils	B
528 Accumulating Reproducer—9 foils	B
602A Calculating Punch—7 foils	B
604 Electronic Calculating Punch—7 foils	B
Organizational Concept of Business—5 foils	A
Data Preparation and Classification—39 foils	A, B
Calculating Machines, #602A, 604—24 foils	B
Accounting Machines, #402-3, 407—29 foils	B
Other Machines, #46–47, 63, 65–66, 101, 528, 824, 884—55 foils	B
Special Devices—18 foils	B
Mounts for Overhead-Projector Foils (empty mounts for use in mounting foils)	General, B
Container for Visuals (box to store foils, filmstrip cans, and slide containers)	General, B
#77 Control Panel Chalkboard	B
#85 87 Control Panel Chalkboard	B
#402–403 Control Panel Chalkboard	B
#407 Control Panel Chalkboard	B
#514 Control Panel Chalkboard	B
#519 Control Panel Chalkboard	B
#533 Control Panel Chalkboard	D
#521 541 Control Panel Chalkboard	B
#529 542 Control Panel Chalkboard	B
#552 Control Panel Chalkboard	B
#557 Control Panel Chalkboard	B
#650 Planning Chart Chalkboard	D
#650 Console Chart Chalkboard	D
#5081 Card Chalkboard	A, B
#602A Planning Chart Chalkboard	B
#604 Planning Chart Chalkboard	B
#101 Control Panel Chalkboard	B
#85 87 Card Feed Schematic Chalkboard	B
#514 519 Card Feed Schematic Chalkboard	B
#528 Control Panel Chalkboard	B
#528 Planning Chart Chalkboard	B
#705 Programing Chart Chalkboard	D
#705 Auto Coder Programing Chart Chalkboard.	D
#602A Control Panel Chalkboard	B
#604 Control Panel Chalkboard	B
#650 Soap Programing Chart Chalkboard	D
#407 Control Panel Chalkboard	B
#305 Control Panel Chalkboard	D
#380 Control Panel Chalkboard	D
#370 Control Panel Chalkboard	D
#323 Control Panel Chalkboard	D
#305 Programing Chart Chalkboard	D
#610 Control Panel Chalkboard	D
#610 Programing Chart Chalkboard	D

Note: The Data Processing Management Association, 524 Busse Highway, Park Ridge, Ill., publishes a "Catalog of Audio-Visual Aids for Data Processing Systems and Automation." This publication may be obtained from the Association.

Demonstration Equipment

Philco Corporation, Techrep Division, C and Ontario Sts., Philadelphia 34, Pa.:

	Course
Binary Numbers Trainer #368-37032	A, C
Computer Systems Lecture Demonstration Unit #463–4667.	A, D, E
Display Rack #368–33335 for #463–4667 Demonstration Unit.	General
Power Supply #368–33335 for #463–4667 Demonstration Unit.	General

Appendix C

LIBRARY WORK CENTER

A LIBRARY WORK CENTER is a necessary part of data processing facilities. It should be located close to the data processing equipment, preferably as a section of the laboratory or in an adjoining room. Because of the specialized nature of the reference materials and the need for continuous accessibility, the data processing library should not be a part of the main school library.

The work center should have display racks, shelves, and tables. It should be supplied with texts, manufacturers' manuals, and periodicals pertinent to data processing. It should also contain indexes, catalogs of program libraries, and samples of programs in card and tape form. Provision should be made for expansion as new audiovisual equipment and new equipment for programed learning become available.

Students will use the center for studying manufacturers' instructions; for studying equipment not available at the school; for preparing assignments and reports not covered in classwork; and as a reference source for the solution of problems. Most important of all, the library will serve to acquaint the student with sources of reference material and impress upon him the need for this material in keeping up to date in this fast-changing field.

Appendix D

DATA PROCESSING FIELD PROJECT

ONE OF THE CHARACTERISTICS of a good technical curriculum is the provision that, as the student progresses, he will be placed more and more upon his own resources. Ideally, upon graduation he should have reached a full understanding of the conditions and requirements for production in the world of work.

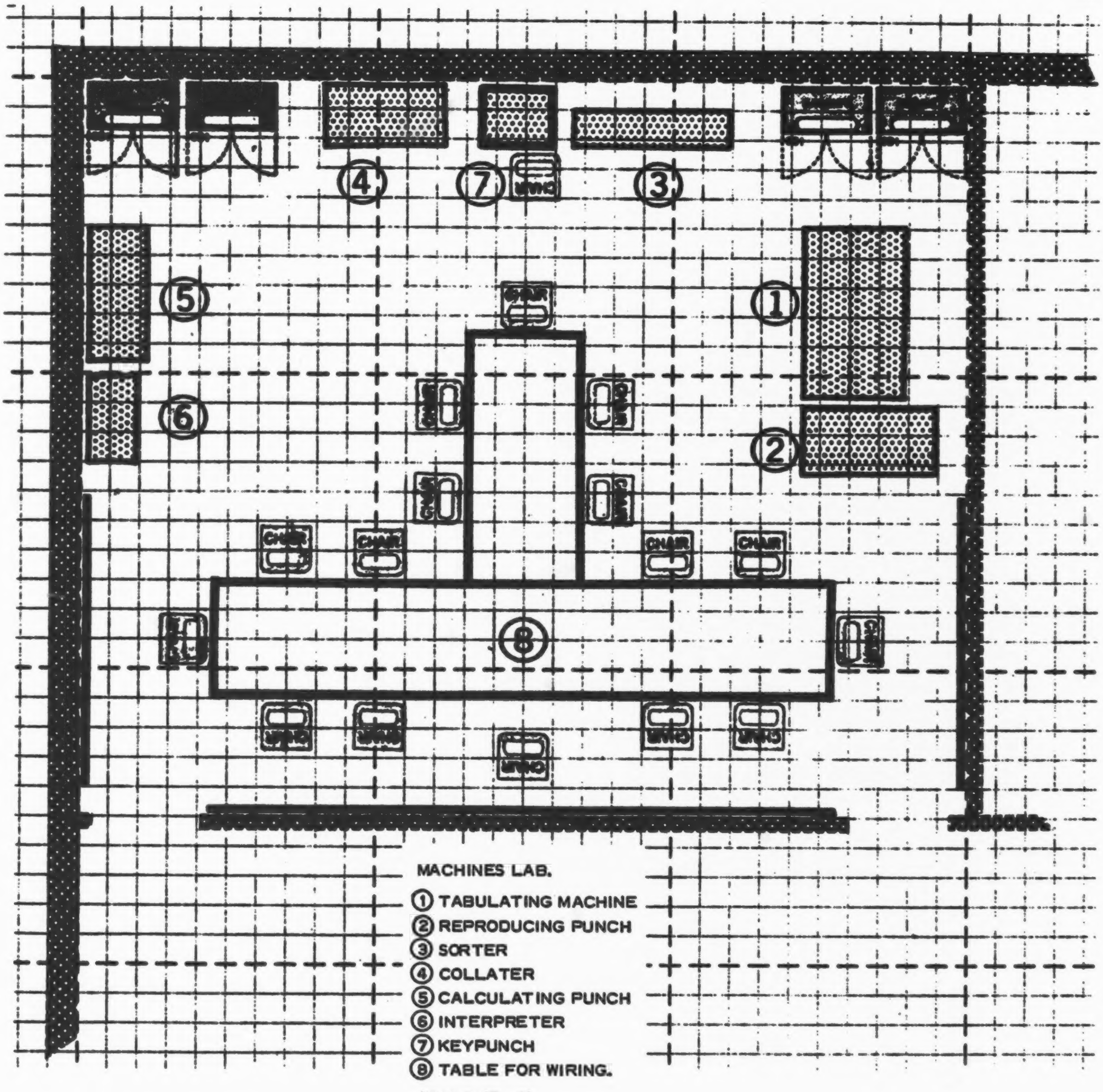
The purpose of C 262 *Data Processing Field Project* (see p. 33) is to give the student an opportunity to initiate and carry out a project taken from outside the school. The procedure outlined for the field project is one method of carrying out this purpose. However, the method and number of hours will vary from school to school, depending upon the availability of outside resources.

Whatever method is used, the objective should be to place responsibility upon the student to solve a significant problem with minimum of teacher assistance; to have the problem, if possible, involve procedures and equipment not found in the school; and to have the student become acquainted with the work of employed data processing personnel. The results of the project should be documented and reported in an acceptable form, preferably in both oral and written reports. All procedures should approximate those to be encountered under actual working conditions. In its final form the problem solution should be judged on its feasibility; nothing but a working solution should be accepted.

The suggested outline is only one approach to promoting such an experience. There are many other ways. In some school situations it may be desirable, wherever possible, to use a cooperative program in which the students work part time on the job. Such a schedule requires considerable coordinating work on the part of the teacher; it calls for special programing of students, particularly where large numbers of students are involved, and it may interfere to some extent with the operation of regularly scheduled classwork. All these factors must be considered in planning this kind of outside project work.

Another method, although probably the least desirable from the work experience point of view, is the assignment of term research problems by the teacher to groups of students. Between the two extremes of a problem worked entirely in school and one worked entirely outside at a local installation, there are many possible choices. Students may spend some time at a local installation selecting a problem, return to the school to work out a solution, and then submit the answer. Students may choose a more or less common problem, visit and study various installations, and prepare a report with suggested solutions. Or representatives of industry may be brought into the classroom to supply data for problems to be solved by the students. All of these methods have been used and all have merit.

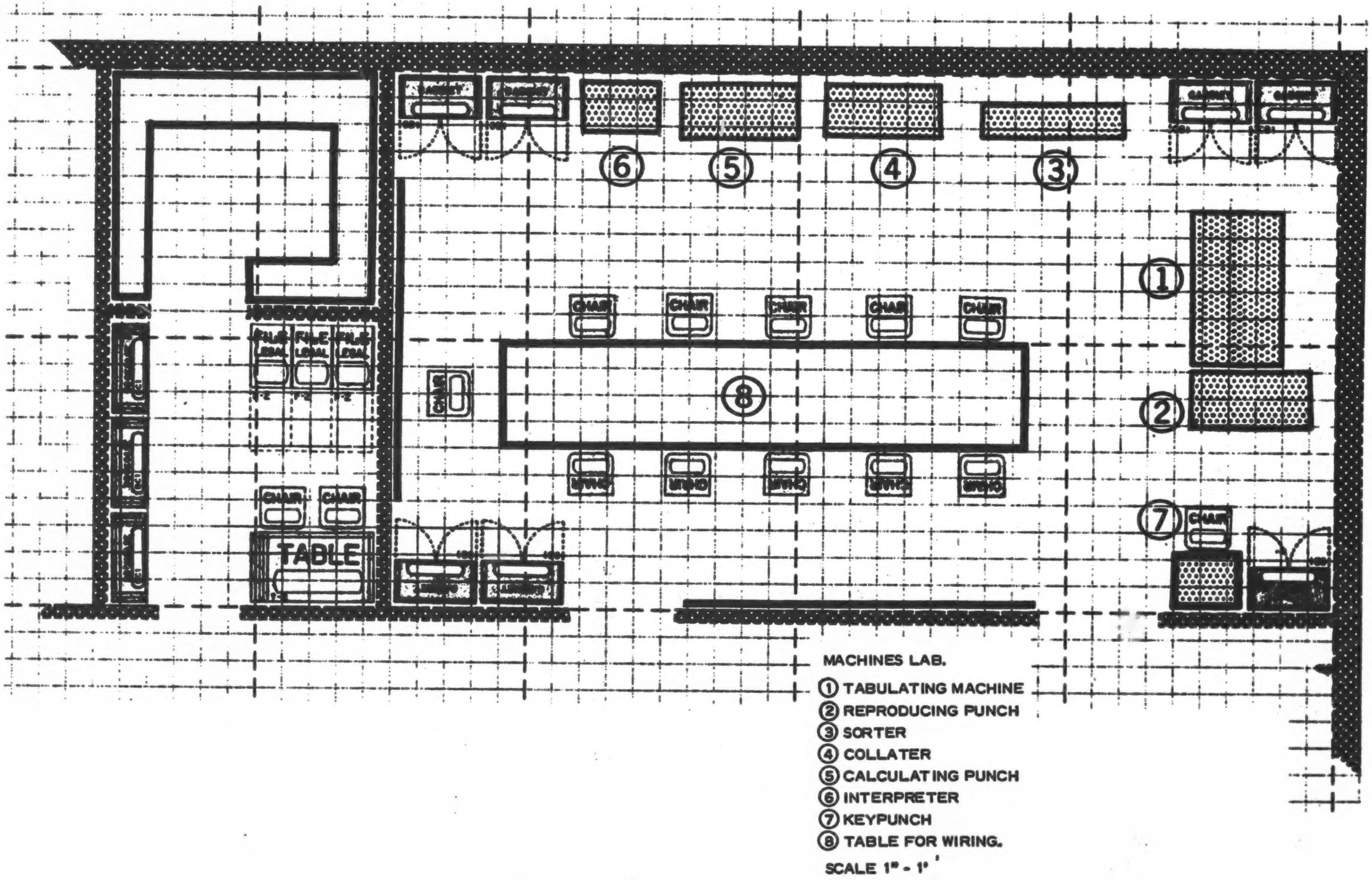
The object of the field project, regardless of the procedure used, should be to involve the student in a real problem emanating from an actual data processing situation. The climate should be such that the student will require a minimum of assistance from the teacher. He should feel that what he is doing is his livelihood and that his career depends on his performance. If this theme can be carried out, not only will the work level of performance be improved, but the opportunity for employment will be enlarged. It will provide a real and comprehensive performance test of the student.



MACHINES LAB.

① TABULATING MACHINE
② REPRODUCING PUNCH
③ SORTER
④ COLLATER
⑤ CALCULATING PUNCH
⑥ INTERPRETER
⑦ KEYPUNCH
⑧ TABLE FOR WIRING.

SCALE 1" - 1'

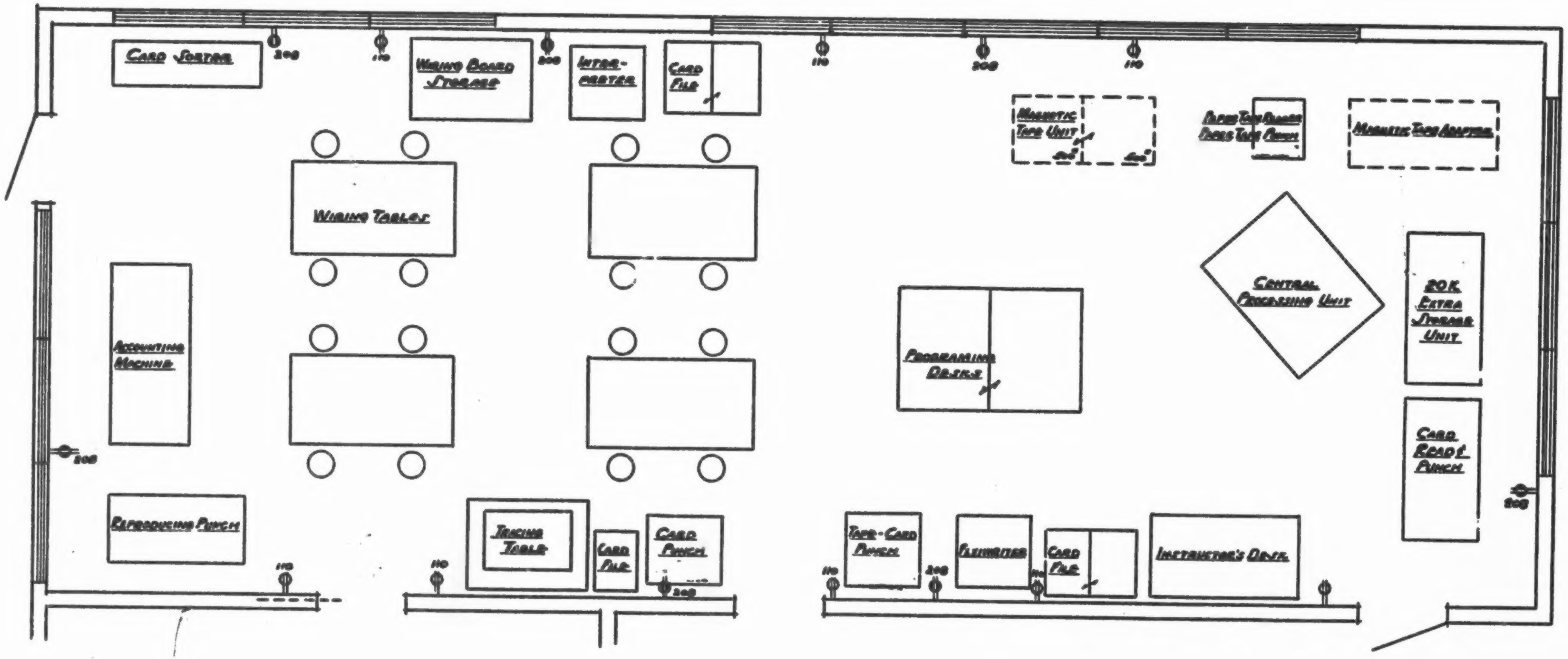


1
2
3
4
5
6
7
8
CHAIR
FILE LEGAL
TABLE

MACHINES LAB.

① TABULATING MACHINE
② REPRODUCING PUNCH
③ SORTER
④ COLLATER
⑤ CALCULATING PUNCH
⑥ INTERPRETER
⑦ KEYPUNCH
⑧ TABLE FOR WIRING.

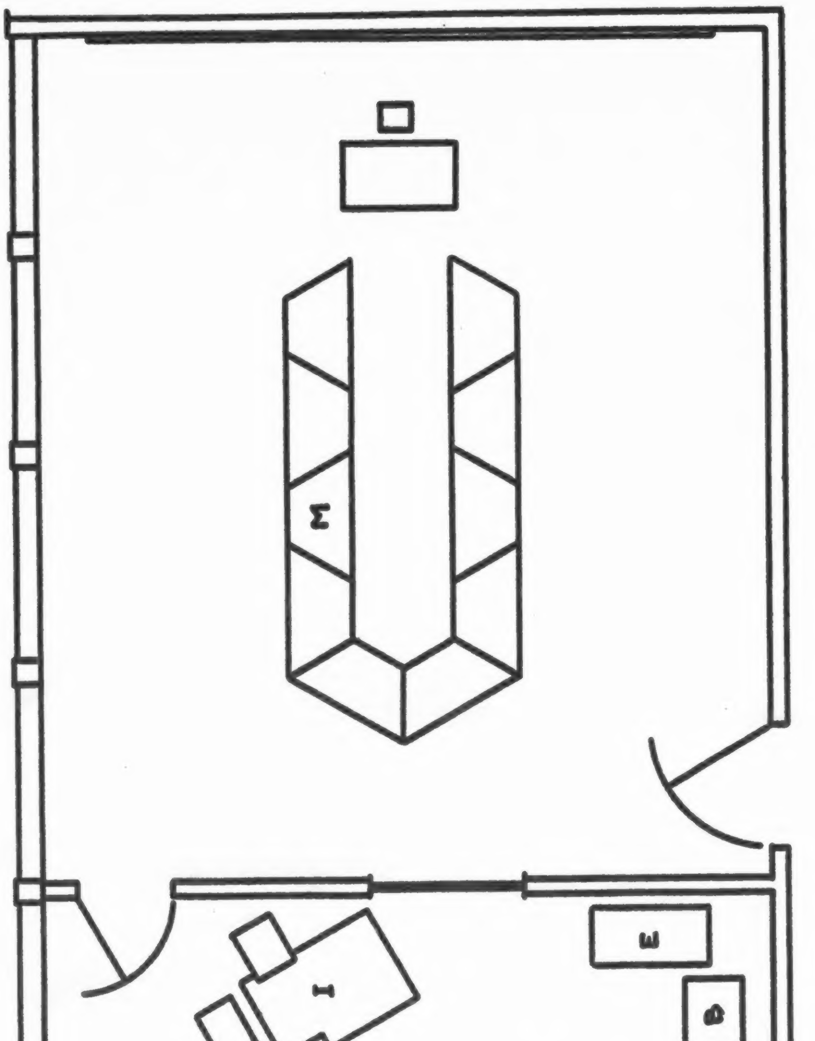
SCALE 1" - 1'


Card Sorter
208
110
Wiring Board Storage
208
Inter-preter
Card File
110
208
110
Magnetic Tape Unit
Paper Tape Reader
Paper Tape Punch
Magnetic Tape Adapter
Wiring Tables
Accounting Machine
Programming Desks
Central Processing Unit
20K Extra Storage Unit
Card Read & Punch
208
208
Reproducing Punch
110
110
Tracing Table
Card File
Card Punch
208
110
Tape-Card Punch
208
Flexowriter
110
Card File
Instructor's Desk

208 Volt Requirements : 100 Amps.
110 Volt " : 40 "
Air Conditioning Requirements : 75,000 B.T.U.
Lighting Requirements At Table Height : 50 Ft. Candles
Machine Weights Are Indicated.

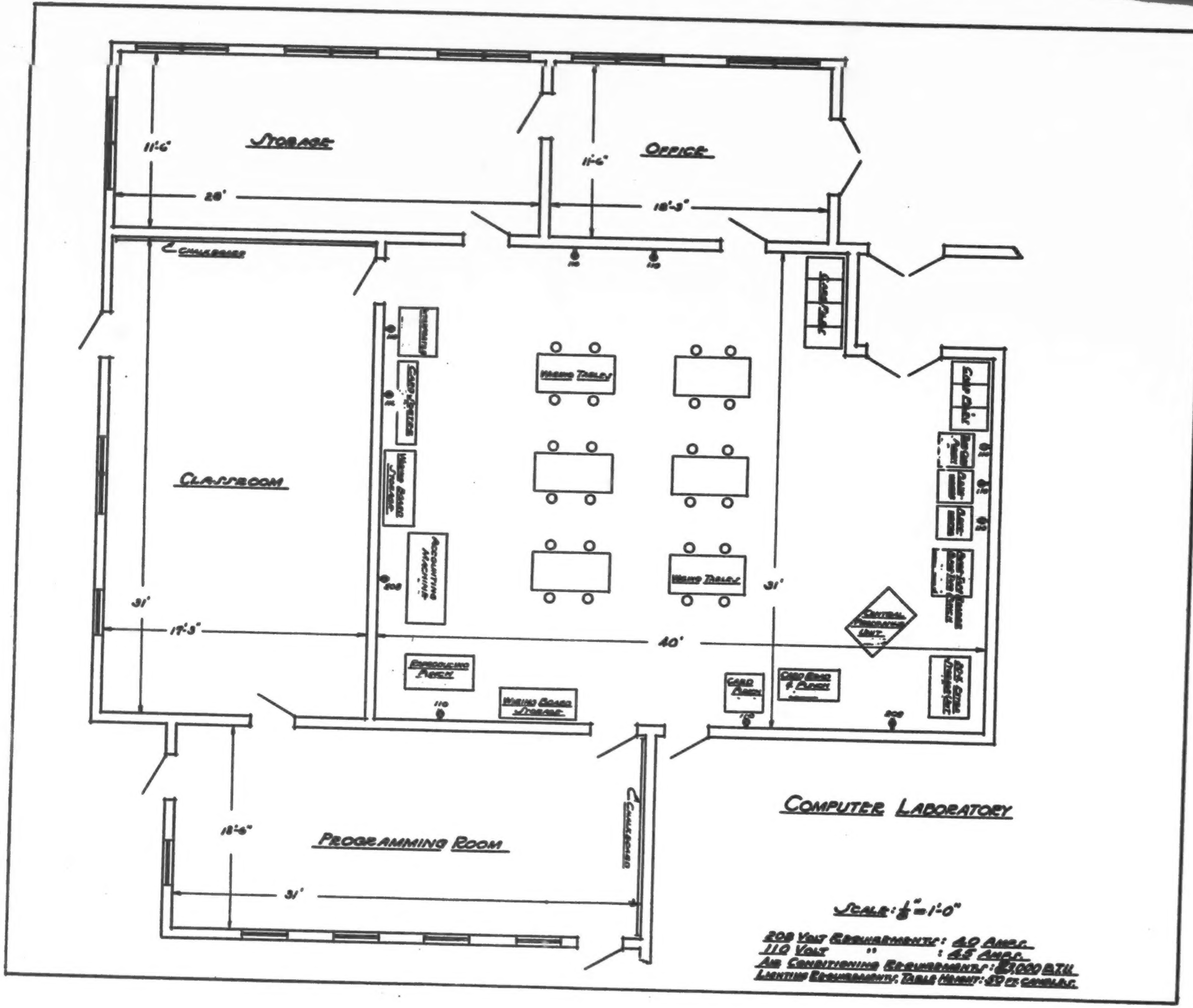
COMPUTER LABORATORY LAYOUT

DATA PROCESSING LABORATORY LAYOUT



A. WIRING POSITION
B. VERIFIER
C. COLLATOR
D. SORTER
E. REPRODUCING PUNCH
F. CARD PUNCH
G. STORAGE CABINET
H. CARD FILES
I. ACCOUNTING MACHINE
J. COMPUTER
K. CONFERENCE TABLE
L. CARD READ AND PUNCH UNIT
M. STUDENT DESKS
N. CARD FILES
O. MASTER STORAGE LOCKER

NOTE: AIR CONDITIONING IS REQUIRED FOR THE LABORATORY


STORAGE
11'-6"
28'
OFFICE
11'-6"
18'-3"
CHALKBOARD
CLASSROOM
31'
19'-3"
WIRING TABLES
WIRING TABLES
31'
40'
CARD FILES
CARD FILES
INTERPRETER
CARD SORTER
WIRING BOARD STORAGE
ACCOUNTING MACHINE
REPRODUCING PUNCH
WIRING BOARD STORAGE
CENTRAL PROCESSING UNIT
CARD PUNCH
CARD READ & PUNCH
110
208
PROGRAMMING ROOM
CHALKBOARD
18'-6"
31'
COMPUTER LABORATORY
SCALE: 1/8" = 1'-0"
208 VOLT REQUIREMENTS: 40 AMPS.
110 VOLT " : 45 AMPS.
AIR CONDITIONING REQUIREMENTS: 83,000 B.T.U.
LIGHTING REQUIREMENTS; TABLE HEIGHT: 50 FT. CANDLES.

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